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THE DEVELOPMENT OF THE CIVIL ENGINEERING DEPT. OF THE U. OF I.

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MEMORANDUM

Concerning

THE DEVELOPMENT OF THE CIVIL ENGINEERING DEPARTMENT

of the

University of Illinois

During the Period

1934 to 1942

by

W. C. Huntington
Head of Department

November 12, 1942

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SUMMARY

This summary is prepared for the convenience of those using this Memorandum. It outlines the topics covered and makes statements which are supported by the data given in the body of the Memorandum.

Reason for Memorandum.--The following statement is taken in full from the Introduction:

This Memorandum was suggested by the survey being made by the American Council of Education to determine whether or not the University has gone forward or backward since 1934. Since the Civil Engineering Department was rated as "Distinguished" in the survey made by that organization in 1934 and since one outstanding man has resigned from the staff since that time, it seems desirable to present for consideration the steps which were taken to offset the effect of that resignation and to give information which will assist in the appraisal of the work of the department from the period 1934 to 1942 as compared with that of preceding years.

Changes in Staff.--The resignations which have occurred since 1934 and the manner in which the vacancies were filled are as follows:

Professor Hardy Cross resigned in 1937. The position was filled by Professor T. C. Shedd who had been selected for the staff by Professor Cross, who worked with him here for 15 years, who is an outstanding teacher, and the author of two leading treatises in his field. In addition, Dr. N. M. Newmark, a young man, was added to the staff in 1934 in a position especially created for him. Professor Cross in recommending him stated that "He is, I think, the ablest man we ever had in graduate work." Professor Westergaard stated, "I believe that his appointment will be a contribution to the difficult problem of future distinction of the University. His intellectual capacity is rare. He is among the few who can be rated as truly brilliant." Recently E. F. Kelley, Chief of the Division of Tests of the Public Roads Administration wrote "In my opinion he is one of the outstanding men in the United States in the field of research in which he is engaged."

Professor Stubbs resigned in 1938. The position was filled by the appointment of Mr. H. P. Evans. The following appraisal is selected from many comparable ones in the letters recommending him. Mr. Rockwell, his immediate superior at the U. S. Reclamation Bureau stated, "It has been mypriviledge, for more than 30 years, to work with and supervise young engineers. I have never encountered a young man who, in my opinion, showed more promise than Mr. Evans..... He has to an unusual degree the ability to grasp the vital points of a problem and arrive at a correct answer by clear straight thinking.... His intellectual capacity is of the highest order." His work on the staff has justified this appraisal.

Mr. K. C. Tippy resigned in 1936. The vacancy was filled by Mr. J. G. Clark, one of our own graduates who had made an excellent record and gave great promise for future development. He has lived up to our expectations.

The work of the department has been strengthened since 1934 by two further additions to the staff. Mr. A. E. Cummings, recognized as being one of the foremost foundation engineers in the country, was appointed Lecturer in Foundation Engineering to give regular lectures in credit courses. He has been extremely well received by the students. Dr. R. B. Peck, a young man who has already become nationally known because of his brilliant research in soil mechanics, was appointed Lecturer in Soil Mechanics in 1942 to give regularly scheduled lectures and is to become a resident Research Assistant Professor next month. Dr. Karl Terzaghi, consultant on the Chicago Subway, selected him to take charge of the soil investigations on that project. This proved to be the largest investigation ever carried out in this field. Mr. V. O. McClurg, in charge of structural design for Holabird and Root, leading architects of Chicago, has said that he expects Dr. Peck to be Dr. Terzaghi's successor as the foremost foundation engineer in the country.

Considering these additions and adjustments which have taken place in the staff since 1934 it seems certain that, from this point of view, the staff has made substantial progress since 1934 in spite of the resignations which have taken place.

Changes in Curriculum.--A new senior option in Railways was added to the curriculum in 1940 when the Department of Railway Engineering was dissolved. This year a new senior option in civil engineering phases of aeronautics, and a new 5-year curriculum in Public Health Engineering were offered for the first time. These additions were made to meet the increasing demand for men trained in these fields. The State Department of Public Health very strongly urged the establishing of the curriculum in Public Health Engineering.

Development of Staff.--The members of the staff who were here before 1934 have shown marked development through the years. This is apparent to anyone who is familiar with the work of the staff. For others, statistical information is given in this memorandum which will assist in appraising this factor. This includes research, technical book writing, articles in technical literature, service on committees of engineering societies, and assistance to public agencies. This information will be summarized in the following paragraphs.

Research.--The number of Bulletins and Circulars by members of the civil engineering staff published by the Engineering Experiment Station for the last three nine-year periods is as follows:

	All Members	Present Members
1916-1924	6	6
1925-1933	15	13
1934-1942	28	27

A comparison of individual publications will show that the research projects have become more comprehensive, and more significant, as the years have passed.

The funds provided by outside agencies and by regular University salary appropriations for research in this department in the Engineering Experiment Station for the last two nine-year periods are:

	Outside Agencies	Regular Salaries	Sewage Research	Total
1925 to 1933	$ 83,000	$ 67,000	0	$ 150,000
1934 to 1942	$149,000	$104,000	$27,000	$ 280,000

As noted above, there have been special appropriations of $3,000 per year for sewage research beginning in 1934, making a total of $27,000 for the nine-year period. Other general appropriations are made for research. The above tabulations show that the funds available for research have doubled during the last nine-year period.

On the basis of the number of publications and the funds devoted to research this activity by members of the staff has practically doubled during the last nine-year period as compared with the preceding nine-year period. The quality of the work is indicated by the general approval and the increasing outside support which it receives. Professor W. M. Wilson devotes his full time to research. The quality of his research is very definitely indicated by his being awarded three medals by engineering societies since 1934 for three papers he has given on his research.

Book Writing.--This department has been outstanding for the number, high quality and broad scope of the technical books it has produced. Data presented in the body of this Memorandum shows that the productivity of this department in this respect is continuing.

Technical Articles.--The comparisons of the technical articles written by members of the staff during the last two nine-year periods show a marked increase during the latter period. The actual totals are:

	All Members	Present Members
1925 to 1933	77	65
1934 to 1942	128	122

The actual numbers are not important but the trend is significant.

Technical Societies.--Every member of the staff is a member of the American Society of Civil Engineers, the major technical society in his field. In addition, members of the staff belong to other societies representing the specialized activities in which they are interested. The total number of societies represented is 20, the total number of memberships is 76, and the average per staff member is 4.5. These figures do not include Sigma Xi and Tau Beta Pi, to which most of the staff members belong.

Statistics given in the Memorandum show that members of the staff are active on the committees of technical societies and that the number of committees on which staff members have served during the past nine-year period is double that for the preceding nine-year period. Selection for membership on committees is a recognition of one's competence in his field and the number of committees is an indication of one's activity in his profession. The totals of the offices and committee memberships of regular members of the staff for the two periods are:

	All Members	Present Members
1925 to 1933	98	88
1934 to 1942	196	187

The actual numbers are not important but the trend is quite significant.

Assistance to Public Agencies.--Since 1934, the assistance which this department has rendered public agencies has been very marked. This includes the Bureau of Ships and the Bureau of Yards and Docks of the U. S. Navy, the U. S. Army Engineers, the Public Roads Administration, the National Resources Planning Board, the National Research Council, the Association of American Railways, the Highway Research Board, the Civil Works Administration, the Illinois Division of Highways, the Illinois State Legislature, the Governor of Illinois, the Illinois Planning Commission, the Illinois Emergency Relief Commission, the San Francisco-Oakland Bay Bridge Authority, the Tacoma Bridge Commission, and others.

The fact that public agencies have come to this department for assistance on a great variety of problems, many of which are important, is a clear indication of the competence of the staff and the high regard in which it is held. The service rendered has always been helpful, frequently it has been very important, and in some cases can only be classed as extraordinary.

Conclusion.--The information presented in this Memorandum shows quite clearly that any disadvantage which may have developed from resignations since 1934 has been overcome and that a distinct advance has been made by the appointment of competent men to positions which did not exist previous to 1934.

The curriculum has been broadened to keep pace with developments in the general field of civil engineering.

The increase in activity and productivity of the department, as evidenced by research, writing and professional activities, has been very marked. No mention has been made of the teaching salary budget. This has increased in keeping with the development of the staff members.

All statistical comparisons which are possible indicate that the activity of the department has doubled during the last nine-year period as compared with the preceding period. As has been stated, the actual numbers and ratios are not important but the trend is significant.

The conclusion that the Civil Engineering Department has gone forward since 1934 seems to be definitely established by the material presented in this Memorandum. The staff is progressive, competent, productive, and developing. Its morale and spirit are very high. The physical facilities for instruction and research are outstanding and are constantly being improved.

The publications and activities of Mr. Cummings and Dr. Peck, who are part-time members of the staff as Lecturers, have not been included in the statistical studies given in this Memorandum although their inclusion might be justified. These would add materially to the record of development since 1934.

Memorandum on

Developments in the Civil Engineering Department of The University of Illinois

From 1934 to 1942

INTRODUCTION

This memorandum was suggested by the survey being made by the American Council of Education to determine whether or not the University has gone forward or backward since 1934. Since the Civil Engineering Department was rated as "Distinguished" in the survey made by that organization in 1934 and since one outstanding man has resigned from the staff since that time, it seems desirable to present for consideration the steps which were taken to offset the effect of that resignation and to give information which will assist in the appraisal of the work of the department from the period 1934 to 1942 as compared with that of preceding years.

When a well-known man leaves a department, there is a tendency to assume that that department has gone backward. This is commonly, but not necessarily, the case. If a competent man is added to the staff or, better still, if the staff has among its members younger men who soon can develop to fill the vacancy, the initial setback may be overcome. However, it must be recognized that a younger man will not usually be as well known as the person who has resigned. For that reason, the loss may be more apparent than real. Resignations and retirements must be considered as normal consequences of the passing of time. The vital question is how well they are provided for.

In this memorandum, the trend of the department will be considered under several heads as follows:

1. Department Policies Concerning Staff
2. Changes in Staff from 1934 to 1942
3. Special Developments and Activities from 1934 to 1942
4. Comparison of Productivity and Professional Activities of Staff Members for the Nine-Year Period 1934 to 1942 and the preceding Nine-Year Period 1925 to 1933.
   a. Engineering Experiment Station Publications
   b. Technical Book Writing
   c. Technical Papers, Articles, and Reports
   d. Committees of Technical Societies
5. Summary (Placed at the beginning of the Memorandum for convenience)

It is recognized that there are many other factors which enter into the determination of the quality of the work of a department but no others are subject to statistical comparisons.

Of course, the most important factor of all is the effectiveness of teaching for that is the principal work of any University department. However, it is impossible to measure this in any definite way. So far as the situation under discussion is concerned, it is certain that teaching in the department has improved since 1934 because, excepting the three resignations, the staff members have become more experienced in teaching and have been continually improving their preparation for teaching.

In examining the data which are submitted, it must be kept in mind that they include only a part of the factors which enter into the determination of a staff member's effectiveness. No statistical comparison of effectiveness in teaching is possible. A good teacher may be ineffective in research and one who is distinguished in research may be a mediocre teacher. A staff member may be of great value to the department even though he has not engaged in research and has not written for publication. Also, there are many departmental, college and university responsibilities whose performance is necessary to the proper functioning of the educational and research program. Some men are particularly effective in this phase of the staffs activity while others are not. As has been stated, these elements are not subject to statistical analysis but it must be realized that they are present. In order to be most effective a staff must be well balanced in these various respects. Since most of the members of the staff have been here through the two nine-year periods, it can be assumed that they have shown the same relative effectiveness in the various phases of the department's work during these two periods. This uncertainty would be present in comparing the effectiveness of different staffs but does not enter the present comparison in any important way.

1. DEPARTMENT POLICIES CONCERNING STAFF

Department Policy.--It has been the policy of the department for many years to so coordinate the members of the staff that any vacancy created by the resignation or retirement of a key member can be filled by another staff member who has been working with him and is adequately trained to step into his position. Such a policy is particularly important to this department at the present time because of the relatively large number of mature men now on the staff. The civil engineering staff is large enough to enable this policy to be carried out by careful planning in the selection of new staff members and the duties which are assigned to them. The present department is well balanced.

Every effort is made to create conditions in the department which will encourage the development of staff members. Young men are closely associated with more mature members of the staff but are not dominated by them. Responsibility is placed on young men as rapidly as they are in position to carry it. They are given

considerable freedom in the procedures followed. Every effort is made to provide them with the facilities required for effective work. Their effectiveness is judged by the results secured. Frequent comments by staff members and their desire to stay here in spite of opportunities to go elsewhere show their satisfaction with the conditions which prevail in this department.

2. CHANGES IN STAFF

There have been only three resignations during the nine-year period under consideration. This is a remarkably small turn-over in a department of 17 men. However, one of these resignations was that of Professor Hardy Cross who had won distinction in structural engineering during his 16 years as a member of the staff. Another resignation was that of Professor F. W. Stubbs who had done very creditable work. The third resignation was that for Mr. K. C. Tippy who had been an instructor for about three years. The 1933-34 Register includes M. S. Ketchum on the staff for that year. He was placed in this position when it became necessary for him to resign from the position as Dean because of ill health. He did not recover but died in 1934 after a distinguished career. However, this career was not as a member of the civil engineering staff so is not pertinent to this discussion.

The person who was in training to succeed Professor Cross was Professor T. C. Shedd who had his undergraduate work at Brown University under Professor Cross and who was brought to the University of Illinois in 1922, upon the recommendation of Professor Cross, to teach structural courses. Professors Cross and Shedd were intimately associated for 15 years at the University of Illinois and for two or three years at Brown. As a result of this close association Professor Shedd became more familiar with Professor Cross' philosophy and methods of analysis than any other person. To these, he has added his own which are very important. Being a younger man than Professor Cross, he is in position to carry on for a longer period in the future. Professor Shedd has had extensive experience in structural design and is often called upon by practicing engineers for assistance when difficult problems are encountered. His writings are notable because of his thorough appreciation of actual design as well as theory. Professor Cross depended upon him to provide instruction in this phase of structural engineering. Professor Shedd is known as one of the best teachers in the College of Engineering and one of the best teachers of structural engineering in the country. He is joint author, with Professor Vawter of this Department, of a book entitled "Theory of Simple Structures" which was published in 1931. Immediately this book assumed leadership in this field as evidenced by being more widely adopted as a text than any other book. His book on "Structural Design in Steel" which was published in 1934, has met with equal success. Work is far advanced on the manuscript, which he is preparing, for a book on "Bridge Design" and which already has been accepted for publication. He has carried on extensive research in the economic phases of structural design.

Professor Shedd ably fills the vacancy left by the resignation of Professor Cross but in addition, the outstanding work in this field by Professor N. M. Newmark must be considered. Immediately after graduation, with special honors, at Rutgers University in 1930, Mr. Newmark was appointed a Research Graduate Assistant in our Engineering Experiment Station where he worked for two years under Professor W. M. Wilson. He continued with graduate work and was awarded the doctor's degree in 1934. During this period, his work was directed by Professor Cross but he continued his studies under Professor Wilson and also studied under Professor Westergaard. His work with all of these men was so outstanding that Professor Wilson recommended that a permanent position be created for him on the civil engineering staff of the Engineering Experiment Station. In a letter of recommendation for this appointment Professor Cross states that, "He is, I think, the ablest man we ever had in graduate work. He has a great power for originating methods and viewpoints." Professor Westergaard expressed his opinion of Dr. Newmark as follows: "I believe that his appointment will be a contribution to the solution of the difficult problems of future distinction of the University. His intellectual capacity is rare, his personality attractive. He is among the few who can be rated as truly brilliant." The appointment was made. He was given no definite assignment but was free to select his own work and carry it on as he pleased. That this policy was a wise one is evidenced by the remarkable work he has done since his appointment in 1934, a part of which has resulted in the publications listed later in this memorandum. Dr. Newmark, although still a young man, has won considerable distinction and is already recognized as one of the country's outstanding men in his field. In a recent letter to Dean Enger, Mr. E. F. Kelley, Chief of the Division of Tests of the Public Roads Administration, who has a wide acquaintance among structural engineers, made this comment concerning Dr. Newmark: "In connection with the investigation of concrete floor slabs that is being conducted at the University.....I have had an opportunity to obtain a personal knowledge of his ability. In my opinion he is one of the outstanding men in the United States in the field of research in which he is engaged. In fact, I do not know of anyone else who has the unusual technical ability that is required by this difficult research and at the same time the thorough appreciation of practical considerations that is necessary to the successful utilization of its results." He is now serving as Consultant to the following organizations: The Committee on Passive Protection Against Bombing of the National Research Council; the National Defense Research Committee; and one of the builders of concrete ships for the Maritime Commission. In relating the work of Professor Newmark to the general theme of this memorandum it should be kept in mind that the position he occupies did not exist before 1934 and that his appointment, therefore, represents a development in the department which has taken place entirely during the period in question.

The vacancy created by the resignation of Professor F. W. Stubbs was filled by the appointment of Mr. H. P. Evans, who graduated at Carnegie Institute of Technology in 1932, where he ranked first in his class and was the recipient the annual award of the Pittsburgh Section of the American Society of Civil Engineers for being the most oustanding civil engineering student. In a letter of recommendation, Professor McCullough, Head of the Civil Engineering Department at that institution stated that: "In my opinion he possesses to a marked degree intellectual capacity and promise of future development." Professor Geckeler of that institution wrote that: "He has the capacity for growth and should draw attention in the future." Immediately upon graduation, he was awarded a research assistantship at the University of Iowa and was granted the master's degree in 1933. Professor Sherman Woodward, under whom he studied, wrote that he had "the highest opinion of his ability both as to intellectual capacity and promise of future development. I consider him about as good as any student we ever had." After securing his master's degree, he obtained a position with the U. S. Reclamation Bureau where he had three years of experience in the design of hydraulic structures. Mr. Kotner, in charge of dam design stated that "Mr. Evans came to the Bureau with an unusually good education and highly recommended. He has fulfilled all expectations in a variety of assignments given him and is considered one of our most valuable younger engineers." Mr. Rockwell, his immediate superior stated that: "It has been my privilege, for more than thirty years, to work with and supervise young engineers. I have never encountered a young man who, in my opinion, showed more promise in engineering work than Mr. Evans. He has had a great variety of assignments, all of which have been completed with the utmost satisfaction both to me and to those in higher positions. He has specialized in hydraulics and has an extremely good understanding of the subject. However, the structural problems given him have been handled just as well as hydraulics. He is a splendid draftsman, a very industrious worker, and has to an unusual degree the ability to grasp the vital points of a problem and to arrive at a correct answer by clean straight thinking..... His intellectual capacity is of the highest order and in my opinion he holds the greatest possible promise for future development." Finally, Mr. W. H. Nalder, Assistant Chief Designing Engineer in Charge of Personnel, stated that "I can highly recommend Mr. Evans as being a young man of exceptionally high intellectual capacity and technical ability.....he is outstanding among our younger engineers and I know of no one better qualified for an instructorship in civil engineering or who in my judgment has better promise for future development." In appraising the last statement it should be kept in mind that the Reclamation Bureau employed nearly a thousand engineers at the time this statement was made and that a large proportion of these were young men. These comments emphasize Mr. Evans' natural ability, excellent training and promise of future development. During the six years he has served as a member of this staff he has entirely justified the opinions which have been expressed.

Also, during the intervening summers he has taken the opportunity to broaden his contact with actual engineering work by securing employment with engineering organizations such as the American Bridge Company and Greeley & Hansen, Consulting Engineers of Chicago. Men in these organizations have spoken enthusiastically of Mr. Evans as a man and as an engineer. By filling a vacancy with a man of this caliber, it seems certain that the department has maintained its standing.

Mr. J. G. Clark was appointed as instructor in 1936 to fill the junior position in the department which had been occupied by Mr. Tippy. He graduated at the University of Illinois in 1935 and was awarded the master's degree in 1939. At the time of his appointment he was with the U. S. Bureau of Reclamation. Since Mr. Clark graduated at this institution and his qualifications were well known to us, no letters of recommendation were required. For that reason, comments from others are not available as they were in Mr. Evans' case. However, Mr. Clark made an outstanding record as a student and showed great promise of development. He has made a fine record. Professor Shedd recently stated that Mr. Clark gave promise of developing into a man who could be placed in charge of structures when he retires 16 years hence. Mr. Clark has used every opportunity to improve his preparation for his position. During the school years he has carried on an exhaustive research program on the "Development of Design and Fabrication Specifications for Iron and Steel Structures" and has given considerable time to the study of the "Stability of Hydraulic-Fill Dams." The results, to 1940, of the first investigation were issued in mimeographed form to 600 structural engineers. Eventually, this investigation will be published as a Bulletin of the Engineering Experiment Station. Mr. Clark has devoted each summer to securing experience which would improve his teaching. The positions have been so selected as to give him well-balanced experience as evidenced by the following list of positions for six summers:

Designer and detailer of reinforced concrete structures with the U. S. Reclamation Bureau in Denver, Colorado

Detailer and calculator of steel structures with the American Bridge Company at Ambridge, Pennsylvania

Designer of steel bridges with the Bethlehem Steel Company, Bethlehem, Pennsylvania

Designer and estimator of steel structures with the American Bridge Company at Pittsburgh, Pennsylvania

Bridge designer with Howard, Needles, Tammen, and Bergendoff, Consulting Engineers, Kansas City, Missouri

Structural analyst on airplanes with the Curtiss-Wright Corporation at Columbus, Ohio

Mr. A. A. Brielmaier joined the staff as an Associate in 1937. He was awarded the degree of Bachelor of Science by Case School of Applied Science in 1926 and the degree of Civil Engineer in 1929. He came to the University of Illinois in 1929 as a graduate student and was awarded the degree of Master of Science in 1930. In 1930-31 he studied at Technische Hochschule Dansig on an International Exchange Fellowship. During the summer of 1931, he studied at the University of Geneva in Switzerland. In September 1936, he returned to the University of Illinois to continue his studies toward the degree of Doctor of Philosophy. He has continued work toward this degree on a part-time basis since joining the staff. For the last year and a half, he has been on leave of absence with the U. S. Army Engineers. He has had very extensive experience in structural engineering with the U. S. Army Engineers and several firms of consulting engineers. He reads and speaks German readily and reads French. He has made many technical translations from the Engineering Library and is the author of a "German-English Glossary" published by the Engineering Experiment Station. His research has been devoted to his doctor's thesis on "Buckling of Compression Members". Mr. Brielmaier is an experienced structural designer who is extremely well qualified for teaching in this field.

The work of the department has been strengthened since 1934 by the addition to the staff in September 1941 of Mr. A. E. Cummings and Dr. Ralph B. Peck as Lecturers in Foundation Engineering and Soil Mechanics, respectively. Each of these men spends two days a month on the campus giving lectures in regular courses, advising with members of the staff on research projects and discussing with them the various developments in their fields. Mr. Cummings is one of the foremost foundation engineers in the country. He is invited to present papers at nearly every conference on soil mechanics and foundations which is held in this country. He has lectured at ten universities during the past five years and has been on the staff of the Graduate School of Engineering at Harvard University as Lecturer on Foundation Engineering since 1939. However, his association with the University of Illinois is much more extensive than with Harvard. Mr. Cummings has contributed many important papers to the Transactions of the American Society of Engineers, the Proceedings of the Highway Research Board, the Journal of the Boston Society of Civil Engineers and other technical publications. He has recently been appointed as a member of the Executive Committee of the Soil Mechanics and Foundation Division of the American Society of Civil Engineers.

Dr. Peck is a young man who has won distinction in his field at an early age. He was awarded the bachelor's degree by Rensselaer Polytechnic Institute in 1934, the doctor's degree in 1937 and studied at the Graduate School of Engineering at Harvard University in 1938-39. He has had experience in structural steel design with the American Bridge Company and in foundation investigations under Dr. Arthur Casagrande of Harvard University. In 1939, Dr. Karl Terzaghi, who is the world's outstanding authority on soil

mechanics and foundations was appointed consultant on the Chicago Subway construction. He selected Dr. Peck to have charge of the soils investigation for that project. This was the most comprehensive investigation of its type ever undertaken and involved the expenditure of over $100,000. Dr. Peck's work on this project won him national recognition in his field. When his work on the subway was completed, Dr. Peck joined the staff of Holabird and Root, Architects of Chicago, as Consultant on foundations, the position he now occupies. He is joint author with Dr. Karl Terzaghi of a book which is to be published next spring but whose title has not been announced. Beginning at an early date, he will assume the position of Research Assistant Professor, at least for the duration of the war and quite probably as a permanent member of the staff.

The records of Professor Shedd, Dr. Newmark, Mr. Evans, Mr. Clark, Mr. Brielmaier, Mr. Cummings, and Dr. Peck have been presented in detail because Professor Shedd has replaced Professor Cross as an instructor and in research, Dr. Newmark was added to the staff at the beginning of the period in question and has carried on research in the field in which Professor Cross was interested. Mr. Evans' record is included because he replaced Professor Stubbs. The records of Mr. Clark and Mr. Brielmaier are included because these men have joined the staff since 1934. Mr. Cummings and Dr. Peck have been serving as Lecturers since September 1941. The position occupied by Dr. Newmark, Mr. Cummings, and Dr. Peck did not exist before 1934. They represent a marked development which has occurred in the staff since that date.

Development of Staff Since 1934.--Since the 13 members of the staff, who have not yet been mentioned, were here before 1934, it seems unnecessary to prolong this memorandum by discussing the qualifications of these men. The pertinent considerations are those which indicate the effectiveness of each man in 1942 as compared with that in 1934. Of course, the most important consideration is his development as a teacher. It is impossible to present tangible evidence of this. From frequent comments of students and graduates, it seems certain that the teaching done in this department is excellent. However, since it is relative effectiveness in 1942 and 1934 that is under consideration, it seems possible to present tangible evidence concerning this phase of the department's work. All of the staff members in this group have continued to develop since 1934. In some cases this development has been very marked. Evidence of such development is given later in this memorandum.

The arrangement of statistical material given later in this memorandum is approximately in the order of position in the department.

3. SPECIAL DEVELOPMENTS AND ACTIVITIES

This section of the report is devoted to developments in the work of the department from 1934 to 1942 which seem to warrant special comment. The developments which have occurred in the curriculum are presented. The entire research program is included because it is not possible to separate the normal work from that which might be considered as special, however, as noted elsewhere the research program for the past nine years is double that of the preceding nine-year period, which in turn represented a considerable increase over the period which preceded it. The expansion in research has been very marked. The assistance which the department has rendered public agencies during the last nine-year period is quite outstanding. There was little activity of this type during the preceding nine-year period. Such a condition might be expected in a staff which is developing and is becoming more generally recognized as the staff members become more experienced.

The material on this subject will be arranged in four groups as follows:

a. Development of Curriculum
b. Developments in Research
c. Assistance Given Public Agencies
d. Conferences and Short Courses

a. Development of Curriculum

Public Health Engineering.--Beginning with the current school year a new curriculum leading to the degree of Bachelor of Science in Public Health Engineering has been added to the curricula administered by the Civil Engineering Department. This curriculum is offered to meet the increasing demand for engineers trained in this field. The studies during the first three years are the same as those required of all students in civil engineering. During the fourth year, specilization is started in sanitary engineering and at the end of that year the degree of Bachelor of Science in Civil Engineering is awarded. The first semester of the fifth year is devoted to biological and chemical science and public health engineering while the second semester is spent at the College of Medicine in Chicago taking specialized work in the Department of Bacteriology and Public Health. The Civil Engineering Department has the enthusiastic cooperation of the State Department of Public Health in this curriculum and in placing its graduates. H. E. Babbitt, Professor of Sanitary Engineering, is in direct charge of the curriculum.

Aeronautical Option.--Beginning with the current school year, the civil engineering curriculum includes a senior option covering the aeronautical phases of civil engineering including aerodynamics, the structural design of airplanes, airport design and aerial navigation. This option is built on a strong basic training in structural analysis and design including statically indeterminate structures, and includes the application to the design of airplanes and hangars. It develops the principles of drainage and highway design and applies them to the drainage of airfields and the construction of runways. The Department of Electrical Engineering is cooperating in providing instruction on airport illumination. The department is well manned for such an option with Professor Shedd's specialized knowledge of statically indeterminate structures and space frames, Mr. Clark's knowledge of indeterminate structures and experience with

Curtiss-Wright Corporation in airplane design, Professor Crandell's experience in airport layout and design, Professor Doland's experience as consultant with the U. S. Army Engineers in the construction of the Caribbean Bases, Professor Newmark's specialized training in the theory of elasticity, and Mr. Dell's experience in navigation with the U. S. Coast and Geodetic Survey and in teaching navigation in the Civil Aeronautics program. There has been a strong demand for civil engineers in aeronautical engineering and many of our graduates have secured positions in this field, some of considerable responsibility. Great developments are taking place during the war period and it is expected that there will be intense activity after the war. However, there is a possibility that, when peace returns, the supply of aeronautical engineers will be greater than the demand. If that is the case, the graduates from the aeronautical option can readily enter other phases of civil engineering. The training value of courses in aeronautics is high and student interest in this field is acute. These factors are brought together in the aeronautical option.

Railway Option.--In 1940, the Department of Railway Engineering was dissolved because of its very small and declining registration and the resultant high cost of instruction. The various curricula offered by that department were placed in the Departments of Civil, Mechanical, and Electrical Engineering. In the Civil Engineering Department, a Railway Option was added to the senior option.

The small registration in railway engineering can be explained, partially at least, by the fact that universities do not usually have Railway Engineering Departments, so the existence of such a department would not be known to many incoming students and by the fact that it required the selection of a very specialized field at the beginning of the sophomore year when students usually have not made up their minds on the specialized field which interests them most.

It is hoped that by placing the railway courses as senior options or electives in the major engineering curricula the interest in such work will increase. These courses have a much larger body of students to draw upon than they did in a small department of railway engineering. The renewed interest in railways on the part of the public, the recent developments in railway transportation, and the improved financial condition of the railways should result in greater opportunities in this field and a resultant increase in the enrollment in railway courses.

Soil Mechanics and Foundation Engineering.--During recent years, there has been a large and growing interest in soil mechanics and foundation engineering due largely to the work of Dr. Karl Terzaghi. As a result of this interest, many schools are offering courses in soil mechanics. Difficulties are encountered, however,

because the field is full of uncertainties, is developing rapidly, suitable textbooks have not been available and, most important of all, the subject cannot be presented adequately by persons who have not had extensive field experience. Such persons are scarce. Most of the courses now taught in universities emphasize the laboratory phase of this subject and it is sometimes considered that a laboratory course in soil testing is a course in soil mechanics. This point of view is strongly objected to by such authorities as Dr. Terzaghi and Dr. Casagrande who are the two leading authorities in this field.

This department has been active in developing work in soil mechanics and foundations on a conservative basis. It has a well equipped laboratory and offers elective undergraduate and graduate courses in "The Properties of Soils" but not "Soil Mechanics", taught by Professor E. E. Bauer who is an experienced laboratory teacher. He has had special training under Dr. Terzaghi. The undergraduate and graduate courses in "Earth and Masonry Structures" including foundations, have kept pace with the developments of basic principles which apply to such structures. These are taught by Professor W. C. Huntington.

In order to obtain intimate contacts with field investigations, Dr. R. B. Peck and Mr. A. E. Cummings have been added to the staff as Lecturers in Soil Mechanics and Foundation Engineering, respectively. The qualifications of these men are discussed in the section on "Changes in Staff" so will not be repeated. They are recognized as outstanding authorities in these fields. These men lecture in regular courses and advise on research. To supplement their lectures, series of lectures were given last year by Dr. Karl Terzaghi and Dr. Arthur Casagrande of the Graduate School of Engineering of Harvard University; Dr. Ralph E. Grim and Dr. George E. Ekblaw, of the Illinois Geological Survey; Mr. Louis Berger of the U. S. Army Engineers; and members of the civil engineering staff. It is planned to continue this arrangement. Emphasis is placed on the behavior of soil in the field as evidenced by actual engineering rather than on the laboratory phases of soil testing. Dr. Casagrande has stated that ninty per cent of the latoratory tests which have been made on soil samples might better never have been made because they are misleading and, therefore, dangerous. Dr. Terzaghi, who is thoroughly familiar with the instruction which is being given in this subject throughout the country, strongly endorses the program at this institution. Plans are underway for further development.

b. Developments in Research

Two members of this department are on the research staff and devote their time chiefly to research although each teaches a graduate class. These are Research Professor W. M. Wilson and Research Assistant Professor N. M. Newmark. A special appropriation of $3,000 has been made each year since 1934 for sewage research. This is assigned to Professor H. E. Babbitt. Other smaller appropriations are made for research in general. Many teaching members of the staff are engaged in research but this work is less extensive because their major task is teaching. A large proportion of the funds for research are provided by outside agencies as stated elsewhere.

The facilities for research in this department are unsurpassed and are improving. An inspection of these facilities, located chiefly in Talbot Laboratory, would be very convincing. Appropriations have been made and plans have been prepared for a new Sewage Research Laboratory. By avoiding all critical materials in the plans, the approval of the War Production Board for the erection of this building was secured. It is expected that contracts will be awarded very soon.

Statistical information concerning the activity in research for the nine-year period 1934 to 1942, as compared with the nine-year period 1925 to 1933, is given on pages 27 to 32 of this memorandum. These will not be repeated but they show that, both in number of publications of the Engineering Experiment Station and in amount of money provided by outside agencies for research, this activity has doubled in the last period.

The object of this section is to give some idea of the magnitude, character, and scope of the research programs of this department. Most of the projects mentioned have progressed to such a stage that results have been published, one or two are about ready for publication, and one which is far advanced is mentioned. No projects which are not extremely active are included although many such are underway in the department, their progress being determined by the time available for research on the part of teaching members of the staff. Only the projects which were active during the last nine-year period are mentioned.

Welding Research.--Several projects on structural welding have been carried on by Professor W. M. Wilson during this period and several Bulletins giving the results secured have been issued. Others are underway. All of these were undertaken to answer questions which have been brought up by engineers because of the trend from riveted to welded structures.

One investigation was carried out for the Nickel Plate Railway to determine the effectiveness of increasing the size of bridge members by welding additional metal to them. Many perplexing

problems were involved. The results secured were vital, conclusive and of great value to the profession because one of the important problems of the railways is that of increasing the capacity of existing bridges to carry the greatly increased loads which are being placed upon them.

Fabrication of steel structures by welding instead of riveting has been adopted reluctantly by engineers partly because of the feeling that welded joints would have low resistance to repeated loads, usually called fatigue. The U. S. Navy is particularly interested in this investigation to secure information for use in the design of welded warships. Because of these conditions, the Engineering Foundation sponsored an extensive investigation by Professor Wilson which was begun in 1938 and has been financed through 1943 on the basis of an expenditure of $10,000 per year. Two Bulletins have been published on this research and preliminary drafts of two additional Bulletins have been written. It is expected that base specifications for welded steel structures will be formulated from this research. The organizationsproviding the funds are: The Public Roads Administration, the Chicago Bridge and Iron Company, the Bureau of Ships of the U. S. Navy, the Association of American Railroads, and the Aetna Iron and Steel Company. Professor Wilson was awarded the Chanute Medal of the Western Society of Engineers for a paper on his welding research.

There has been a trend toward the use of low-alloy structural steel having a static strength somewhat greater than that of the usual structural steel. Little was known of the comparative effectiveness of riveted and welded joints made of the two classes of steels. This investigation has provided important information on these subjects which has been published as a Bulletin.

Fatigue Tests of Riveted Joints and Connections.--The possibility of failure of metal after many repetitions of a load considerably below the static strength of the metal has been known for many years and tests have been made on small machined specimens. Only recently, there was a realization that fatigue tests of small machined and polished specimens gave no dependable indication of the fatigue strength of structural members. Professor Wilson undertook an investigation to obtain information on this subject which would be of use to structural engineers. Fatigue machines with much greater capacity than any which had yet been constructed were designed and built. The investigation gave such startling results that restrictions have been placed on the use of low-alloy steels for members subjected to fatigue until further tests can be made. The San Francisco-Oakland Bay Bridge authorities were so interested in this investigation, because of problems which developed on the design of that bridge, that they provided the funds to carry it through. The results have been published as a Bulletin.

Because of the many failures of rivets in the connection angles in the floor systems of steel railway bridges, an investigation was made by Professor Wilson of the fatigue strength of such connections. The results which were published in a Bulletin formed the basis of a new rule of design incorporated in the Specifications for Steel Railway Bridges of the American Railway Engineering Association.

Reinforced Concrete Arch Bridges.--Many multiple-span reinforced concrete arch bridges are constructed but there are many uncertainties involved in the design of such structures. These have required that assumptions which are known to be safe be made. Investigations extending over several years were made by Professor Wilson and completed in 1935. The results secured were significant. They were published in three Bulletins and were presented at the annual meeting of the American Society of Civil Engineers in a paper entitled "Laboratory Tests of Multiple-Span Reinforced Concrete Bridges" on which he was awarded the J. James R. Cross Medal of that society in 1936. As stated in the rules for this award, "The medal shall be awarded to a paper which shall be judged worthy of special commendation for its merit as a contribution to engineering science."

Rigid Frame Bridges.--This type of bridge has come into common use in recent years. It may be constructed of either steel or reinforced concrete. Extensive tests were made by Professor Wilson of reinforced concrete bridges of this type. The results are presented in a Bulletin and in a paper presented before the American Concrete Institute entitled "Tests on Rigid Frame Bridges" which was awarded the Wason Medal in 1938. The medal is awarded "for the paper which shall be judged most worthy of special commendation for its merits." This investigation was financed by the Portland Cement Association.

Cylindrical Shells and Thin Spheres.--Because of the developments in the art of welding, it has become feasible to use the welded tube as a structural member. Two investigations have been made by Professor Wilson on such members, the results of which are published in Bulletins. These have added materially to the knowledge of the behavior of such members when used as columns and in flexure. The results have recently proved of particular significance in the design of certain war weapons and will probably lead to another investigation.

Large steel spheres are being used for the storage of gas under pressure in place of the older type of gas holder. A significant investigation of such structures was made by Professor Wilson and published in a Bulletin.

These investigations were financed by the Chicago Bridge and Iron Company.

Flow of Sludges in Pipes.--In construction, in excavation, in various industrial processes, in the purification of water and in the treatment of sewage it is often necessary to pump through pipes mixtures of liquids and solids. An experimental and analytical investigation was undertaken by Professor Babbitt to develop procedures for determing the power, pipe sizes and head losses which pertain to these operations. The investigation was by far the most complete of any ever carried out. A method was developed which permits the computation of the various factors involved and permits designs to be made with certainty. Some of the applications are the pumping of powdered coal, wood fiber in paper manufacture, concrete in construction and chemicals in the chemical industry. The results, which are published in two Bulletins, have been enthusiastically received by engineers. Another significant investigation carried on by Professor Babbitt deals with the mechanical aeration of sewage. The results of this investigation were published in a Bulletin.

Flood Flows of Illinois Streams.--In the design of the spillway for a dam, the water opening under a bridge or through a culvert, the size of a storm sewer, the height of a levee, and many other engineering works associated with water, a fundamental assumption must be made as to the maximum quantity of water which the structure must discharge in a unit of time and the frequency with which such a discharge may be expected to occur. The frequency of a given discharge is of importance because, if it may be expected to occur only once in a long period of years and if loss of life is not involved, it may be more economical to repair the damage than to spend the sums required to avoid the damage. This investigation which was made by Professor George W. Pickels, contains an analysis of the flood-flow data on 24 Illinois streams. It required many years of careful and skilled study and analysis. The results which are of major importance are published in a Bulletin.

Slab Investigation.--In 1936, representatives of the U. S. Public Roads Administration and the Illinois Division of Highways requested that the Civil Engineering Department undertake an investigation which would remove some of the uncertainties associated with the design of reinforced concrete floor slabs for highway bridges. Since the Department of Theoretical and Applied Mechanics was also interested in this phase of research, a cooperative agreement between the various agencies which have been mentioned was entered into. According to the terms of this agreement, the outside agencies would provide $20,000 per year for this investigation. Professor Frank E. Richart of the Department of Theoretical and Applied Mechanics was placed in general charge of the project and of the laboratory tests, and the analytical studies were assigned to Professor Newmark. The investigation has been continued with a total expenditure to date by the outside agencies of about $100,000 and has yielded very valuable results, which have been published in several Bulletins of the Engineering Experiment Station. Mr. E. F. Kelley, Chief of Division of Tests, of the Public Roads Administration, in a letter commenting on a recent bulletin entitled "Moments

in I-Beam Bridges" by N. M. Newmark and C. P. Siess, stated that the results in this bulletin alone are worth the entire cost of the investigation to date. This is a rather striking statement but when one considers the extremely large expenditures on highway bridges throughout the country, information which permits engineers to design with greater certainty and economy is of great economic value. In any case, this comment, together with the fact that this investigation has continued so long and that there is no thought of discontinuing it, is evidence of the value of the investigation to the designers of highway bridges in this state and throughout the entire country. The participation of the U. S. Public Roads Administration in this investigation insures the general adoption of the procedures developed. Three Bulletins, with Professor Newmark, as senior author, have been published and four by others associated with this project.

Foundation Pressures.--In predicting the settlement of buildings and other structures founded on clay soils it is necessary to compute the intensity of the vertical pressures introduced into the soil by the weight of the structure and the loads it carries. Assumption must be made concerning certain physical properties of the soil. When this has been done the vertical pressures can be computed. This was a very laborious procedure before the Circular by Professor Newmark was published. In this publication, a method is given which reduces the time required from hours to minutes. This has resulted in the universal adoption of his procedures. The method developed for this purpose has been extended to the calculation of the intensity of the stresses in any direction as well as in the vertical direction. A Bulletin covering these further developments is in press and will be available soon.

War Investigations.--An extensive research project dealing with the war effort, which is confidential in nature and, therefore, nannot be described, is being conducted by Professor N. M. Newmark of this department and Professor F. E. Richart of the Department of Theoretical and Applied Mechanics. The importance of this investigation is indicated by the annual appropriation of $20,000 which is being made by the Federal agency for whom the work is being done. A description of this investigation cannot be given at the present time.

Simultaneous Equations.--Many problems in science and engineering involve the use of quantities determined by means of simultaneous equations whose constants are subject to error or variation. Examples in the field of structural engineering occur in the analysis of continuous frames. A similar situation exists in connection with the determination or the interpretation of experimental data, if equations which are subject to observational errors or physical variations are involved. A mathematical investigation carried out by Professor George H. Dell dealt with the effects of such errors. This was published as a Bulletin entitled "The Effects of Errors on Variations in Arbitrary Constants of Simultaneous Equations."

Economics of Structural Design.--Investigations extending over many years by Professor T. C. Shedd have dealt with the economics of structural design and the development of specifications for the design of steel structures. These deal with steel rigid frames, continuous trusses, steel-roof framing, steel railway bridges, reinforced concrete bridges and continuous saw-toothed building frames. The results will be published in the new edition of "Structural Design in Steel" and a new book entitled "Design and Erection of Steel Bridges" for which the manuscript is being prepared and which has been accepted for publication.

Bridge Specifications.--An exhaustive study of the origin and development of specifications for iron and steel bridges is being carried on by Mr. James G. Clark. He has assembled what is probably the most complete collection of bridge and building specifications available anywhere. The results of his investigation to 1940 were duplicated in mimeographed form and sent out to over 600 structural engineers to obtain their comments and suggestions and any additional information which they might be able to provide.

Timber Investigations.--Investigations on the load distribution by laminated timber floors, the stresses in glued laminated timber arches and the strength of glued laminated wood beams impregnated with creosote have been carried on by Professor W. A. Oliver. The results secured have been partially published in the Year Book of the American Railway Engineering Association and the Proceedings of the American Society for Testing Materials.

Study of Cement Prices.--Shortly after Governor Horner took office he was confronted with some problems growing out of what looked like an excessive increase in the prices bid for furnishing cement on the state highways. He asked the President for a committee to study the matter, consisting preferably of an accountant, a concrete man, and a road man. Professors H. T. Scovill, F. E. Richart, and C. C. Wiley composed the committee. After meeting with the Governor, Professors Scovill and Richart visited a number of the leading cement mills east of the Mississippi where the former studied the cost records and the latter the technical operations. Meanwhile Professor Wiley devoted attention to the relation of cement prices to pavement costs. A confidential report was presented to the Governor which apparently resulted in a material reduction in the bid prices and set up a price range that appeared satisfactory to all concerned.

Study of License Plates.--This study was suggested by the Secretary of State who is in charge of motor vehicle registration in Illinois. It related particularly to the numbering system to be used and to better legibility of the plates. Several copies of the report were supplied to the Secretary of State. The result was the retention of the straight numerical system for passenger cars which the studies showed to be the simplest, most rapid and accurate to read, and most free from mistakes in reporting. At the same time it resulted in a redesign of the numerals and their arrangement for greater legibility. Conducted by Professor Wiley.

Study of Road Signs.--These studies were carried out with the full cooperation of the Illinois Division of Highways. They related to the height of signs, the size of signs, the design of legends, the spacing and arrangement of reflector buttons, location of signs, etc. Findings were reported from time to time informally to the Division of Highways and several conferences were held. These studies resulted directly in the adoption of the present height of Illinois road signs. They played an important part in the final design of the railroad prewarning sign which has become part of the standard code adopted by the American Association of State Highway Officials. They had influence on many of our sign details with respect to size, legend and reflectorizing. Conducted by Prof. Wiley.

Stabilized Soil.--Earth has been extensively used throughout the world as a material for the walls of small houses and other buildings. Familiar examples are the adobe houses in the Southwest. In that arid region, little difficulty is experienced with the effect of moisture on such walls but in regions of heavier rainfall earth is not a suitable material for this use unless it is treated to make it resistant to moisture. In an investigation by Professor John S. Crandell and Edwin H. Hansen, emulsified asphalt was used for these purposes. The results secured have extended the possible use of this low-cost building material. They were published in a Bulletin by Mr. Hansen. The interest in this investigation has been very widespread.

Pressures due to Granular Materials.--Since 1934, an investigation of the pressures exerted by granular materials such as wheat, corn, soybeans, sand and cohesive soils has been underway in the department under the direction of Professor W. C. Huntington. When the project started, no reliable device for measuring such pressures had been developed although many investigations had been carried on in various parts of the world using many types of pressure measuring apparatus which have been shown to be defective. The results secured are therefore of questionable value. By 1936 a pressure cell had been devised which greatly reduced these objectionable characteristics and was satisfactory for the experiments on pressures in model and full-size grain bins which were underway. In about 1939, the U. S. Reclamation Bureau started an investigation of the pressures exerted by earth on retaining walls and on conduits and control works buried in earth dams. After investigating the various types of pressure measuring devices, the pressure cell developed here was adopted, thoroughly tested under widely varying conditions, and adopted for use in the retaining wall investigations and for installation in various high earth-fill dams. More recently the Panama Canal engineers have installed such cells in structures which are now being built. Satisfactory performance has been reported.

In 1939, the Illinois Division of Highways requested the cooperation of the department in an investigation to determine the pressures exerted on rigid culverts through earth embankments. A field installation of two types of pressure cells was made in a large

reinforced culvert being constructed near Peoria where the earth fill over the culvert was over 40 feet deep. A cooperative agreement was entered into. A major part of this investigation was the testing of all known types of pressure cells under controlled conditions so that their accuracy could be determined. This is now underway and has yielded significant results. The type of pressure cell most commonly used throughout the country before this investigation started has been shown to give results which are seriously in error. The investigation is continuing at a cost of about $1500 per year and is financed principally by the Division of Highways.

Joints in Concrete Pavements.--The practice of installing joints in concrete pavements to provide for the movements which take place when temperature and moisture conditions change, and to relieve the stresses which occur, is as old as the modern hard-surfaced road itself. A large amount of investigational work has been done by various agencies throughout the country. In about 1930 a type of joint, called the air-cushion joint, was developed which gave promise of giving superior results and which appeared to justify the large expenditure of about $3,000 per mile of pavement for the joints only. This type came into quite extensive use in spite of its cost. When it was not used, the reason was primarily the cost, because most engineers considered it to be the best type of joint available. In 1937 at the request of the Governor of Illinois, the University of Illinois, through the Civil Engineering Department, began an investigation of joints in concrete pavements to supplement the investigations of the Division of Highways. This task was assigned to Professors J. S. Crandell and C. C. Wiley of the Civil Engineering Department, Professor F. E. Richart of the Department of Theoretical and Applied Mechanics, and Professor W. C. Huntington of the former department as chairman. The investigation involved field investigations in many parts of the country, extensive laboratory investigation, and conferences with many highway engineers and groups of highway engineers. One experimental section several miles long was set up in a highway which was being constructed in 1935. In this section 21 types of joints were installed. This included all of the significant types then in use or proposed. They were installed under the supervision of representatives of the joint manufacturers so that no objection could be raised to the results on this basis. The behavior of the joints in this section was observed at intervals and will continue for an indefinite period in the future.

The results of the investigation were extremely significant and have had a pronounced effect on highway practice throughout the country. The committee recommended the abandonment of all types of air-cushion joint because it was found that they failed after two to three years of service and that, after failure, they were not as effective as joints which could be installed at a small fraction of their cost. An independent investigation carried out by the Illinois Division of Highways supported this recommendation. The results of this investigation were so conclusive that the air-cushion joint was abandoned in Illinois and throughout the country. The significance

of this investigation will be appreciated when it is known that the annual expenditure in this country for this type of joint ran into the millions of dollars. The conclusiveness of the findings is indicated by the fact that the manufacturersof the air-cushion joint accepted the situation with very little protest even though it closed the market for this product and caused the abandonment of manufacturing facilities costing many thousands of dollars.

The results of the investigation are to be published in a Bulletin of the Engineering Experiment Station under the joint authorship of members of the staffs of the University and the Division of Highways. The manuscript for this Bulletin is nearing completion. The investigation was financed by the Division of Highways. This involved a direct payment to the University of $10,000 and an indirect cost to the Division of Highways of several times that amount due to services rendered by members of its organization and materials furnished.

Hydraulic Model Tests.--Model tests were made to determine the hydraulic characteristics of the spillway at West Frankfort, Illinois. These tests were the first of a series which were intended to include studies of all of the impounding reservoir spillways in Illinois. The tests made were successful in determining the probable flood capacity of the spillway and indicated certain changes which should be made to insure the safety of the structure. The general program had to be postponed on account of conditions but will probably be resumed in the post-war period. This work was directed by Professor J. J. Doland.

Study of Dolomites in Chicago Area.--An investigation of the dolomites in the Chicago area is being made by Professor E. E. Bauer in cooperation with the Illinois Division of Highways and the Illinois Geological Survey. This investigation has as its main objectives the determination of the durability of these stones for masonry construction, concrete aggregates and for use in sewage filters. The investigation is practically complete and will form the basis for a Bulletin.

Particle Size Determination.--One of the important tests used in classifying soils is that for particle size. The sizes of the larger particles can be determined by sieve analysis but the sizes of the smaller particles cannot be determined in this way. The usual procedure makes use of the hydrometer and calculations based on Stokes' law. Professor E. E. Bauer has made investigations of this procedure and has developed and improved the technique for computing the particle size from the hydrometer test data. He has also pointed out the effect of flocculation on the results secured. The results of this investigation have been described in the Engineering News-Record, the Proceedings of the American Society for Testing Materials, and the Proceedings of the Purdue Conference on Soil Mechanics and its Applications.

c. Assistance Given Public Agencies

Introduction.--There is no distinct line of demarcation between the research program and the assistance which has been rendered to public agencies. For example, much of the research which has just been described was for public agencies or quasi public agencies such as the railroads. This includes such organizations as the United States Navy, the Public Roads Administration, the Illinois Division of Highways, the Association of American Railways, the American Railway Engineering Association, the San Francisco-Oakland Bay Bridge Authority, and others. In the paragraphs which follow other activites of the staff which were undertaken at the request of various public agencies will be described. The important consideration is, of course, the results achieved and not the classifications followed.

Tacoma Narrows Bridge.--Professor W. M. Wilson was engaged as an engineering expert in connection with the Tacoma Narrows Bridge failure. This bridge, which failed after being in service for only a few months, was insured for more than five million dollars. Because of the large sum involved, the insurance companies appointed a board of engineers to determine an equitable basis of settlement for the loss. Professor Wilson was appointed a member of this board. After the failure, major portions of the bridge remained in place and the extent of the loss depended primarily upon whether or not it would be good engineering to incorporate these standing parts in a new structure in view of the fact that they had been subjected to some local overstress. The appointment of Professor Wilson to membership on this board was a recognition of his standing as an authority in the field of the damaging effect of an occasional overstress in localized sections of structural members, a field that has become recognized as one of growing importance.

Highway Finance and Administration.--The Illinois Highway Survey Committee of the 61st General Assembly was created by Senate Joint Resolution for the purpose of studying current highway requirements, including finances and administration, in relation to needed or proposed legislation. Professor C. C. Wiley was appointed special engineer to this committee by Acting Governor Stelle and served from March 29 to June 15, inclusive, in 1939. His duties were to study the general problems, analyze proposed legislation, and act as technical adviser to the committee. His reports were made to the committee and were included in the committee's report to the two houses. Much of the work related to a mode of financing a system of superhighways for Chicago but included a scheme of local roads downstate. Other important bills related to changes in motor license fees and the motor fuel tax. All of these adversely affected the state road program and the committee's work resulted in their elimination. Professor Wiley's work aided materially in keeping the Illinois highway program on a sound basis.

Caribbean Bases.--During the summer of 1941 Professor J. J. Doland served as principal engineer for the Trinidad District of the U. S. Engineers Department in charge of the engineering division. The project involved the construction of air bases and fortifications at Trinidad, St. Lucia, and Antiqua, in the British West Indies, and British Guiana in South America. The work included site inspection formulation of construction policy, and approval of plans and specifications proposed by the Caribbean Architect Engineer. This was a substantial contribution to the war effort by a member of this staff.

National Resources Planning Board.--Professor James J. Doland has been rendering valuable service to the National Resources Planning Board since 1936. In July 1936 he was appointed Associate Consultant and prepared water plans for nearly all river basins tributary to the Mississippi River from its source to Cairo, Illinois. These reports were published in abstract form by the Planning Board. In 1937, he revised the 1936 plans with suggestions from Drainage Basin Committees composed of Regional, State and Federal representatives. These were published in 1937. In 1938, he continued the Basin Committee work which involved conducting meetings and preparatory reports of the meetings held. Emphasis was on evaluation of projects and their relationship to a satisfactory basin plan. In 1939, he continued the Basin Committee work and in the summer was called to Washington for staff duty in charge of the evaluation of projects contained in the Six-Year Federal Construction Program from 1940 to 1946. In 1940, he was appointed consultant for the entire Ohio Drainage Basins. He conducted basin committee meetings and continued the development of integrated plans for both the Ohio and Mississippi drainage basins. In 1941, he continued the basin committee work and was appointed vice-chairman of the Evaluation Sub-Committee of the Water Resources Committee. This committee was charged with recommending action to the Bureau of the Budget for all water projects. Such recommendation is necessary before construction funds are allotted. In 1942, he prepared completely revised Basin plans for the Upper Ohio, Kanawha, and Miami-Scioto-Hocking River drainage. The Evaluation Sub-Committee was changed to the Project Review Committee of the National Resources Planning Board and is charged with the evaluation of all Federal Projects. Professor Doland was also appointed Chairman of the Cooperative Investigation Committee which is charged with the development of techniques and procedures for coordinating the investigation work of the several Federal agencies which may be working in the same region. The purposes are to avoid duplication of effort, to prevent inconsistent findings, and to reconcile conflicts which would be adverse to the best interests of the region. By serving the National Resources Planning Committee in these capacities, Professor Doland is rendering valuable service to the Federal Government and is at the same time gaining experience which reflects favorably on his teaching.

River Basin Reports.--In 1935, at the request of the Illinois Emergency Relief Commission, a study was undertaken by the Civil Engineering Department to determine possibilities for public construction projects in the Basin of the Big Muddy River in southern Illinois on which relief labor could be used. The department requested and received the cooperation of other University departments and the three State Surveys located on the campus. At that time, a large percentage of the population of this area was on relief. The men were mostly coal miners who were out of employment because of the declining demand for coal from the region. They were, therefore, accustomed to manual labor.

For many years, Professor G. W. Pickels had been studying the possibilities in this area for the creation of reservoirs by the construction of dams. Since earth dams involve a large amount of labor and a relatively small material cost, they are ideal work-relief projects. His studies showed that there were desirable dam and reservoir sites located near the center of the relief load and it seemed quite possible that further study on the part of the Relief Commission or other agencies might show that the construction of some of these dams would justify the cost involved.

After considerable discussion by Federal Agencies, the construction of a dam on Crab Orchard Creek by the Resettlement Administration was approved. This was completed at a cost of about $3,000,000 and the first water flowed over the spillway on December 27, 1941 about exactly 7 years after the first visit was made to the site by representatives of the group making the report. Crab Orchard Reservoir is 9 miles long, has a storage capacity of about 30 billion gallons and is the largest lake in Illinois. Two other dams were constructed on tributaries of Crab Orchard Creek and form reservoirs with a combined capacity of about 20 billion gallons. The government-owned area around these projects adjoin the Illini and Shawnee National Forests. The U. S. Forest Service has planted thousands of evergreen trees on this area which will add greatly to its attractiveness.

The recreational possibilities of the lake were discovered immediately as evidenced by the cars, approaching 15,000 in number, which were parked around the lake on some Sundays in the summer of 1941. The lake is located in a region which has little ground water and is often short of water for domestic and other purposes. Water is frequently supplied to some communities in tank cars. Practically no dependable water supply has been available for industrial use. In the summer of 1941, the water shortage was especially serious in Carbondale which is about three miles below Crab Orchard dam. To relieve this situation a water main was run from the town to the reservoir. The most important development which has grown out of the Crab Orchard project is the U. S. Army Ordnance Plant which occupies 35 square miles around the east end of the lake. This land is of little value for farming purposes. The location is desirable

because of the large labor supply available and the excellent transportation facilities. However, the location of the plant at this site was made possible by the water supply in Crab Orchard lake which in turn developed out of the report which has been mentioned. About 50 million dollars was spent in the construction of the plant and the monthly payroll for operation runs into many thousands of dollars. All of this has been of great assistance to this area which has been in such desperate financial condition. It is hoped that the availability of the large water supply will attract peace-time industries and become of considerable permanent value.

Members of the civil engineering staff who prepared portions of this report were Professors G. W. Pickels, H. E. Babbitt, and W. C. Huntington. The latter served as chairman. A hundred-page mimeographed report supplemented with many maps was issued. About 200 copies were distributed but there has been a demand for many more because of its great significance.

In 1937, the Illinois State Planning Board requested the University and the three State Surveys to make a study of the Basin of the Kaskaskia River. This study was similar to the Big Muddy study but more comprehensive. The civil engineering staff members who participated were Professors G. W. Pickels, J. J. Doland, and W. C. Huntington. The latter served as chairman. A three-hundred page mimeographed report was issued. About 1,000 copies were distributed. So far, no practical results have come from this report but it may, at any time, prove to be quite significant.

National Research Council.--Professor N. M. Newmark is serving as Consultant to the Committee on Passive Protection Against Bombing of the National Research Council and the National Defense Research Committee of the Office of Scientific Research and Development. His work is concerned with various topics relating to the defense and war effort. Most of the work is of a confidential nature and cannot be described here. Generally it relates to the development and testing of methods of structural design, particularly in reinforced concrete to improve the resistance to bombing. Professor H. E. Babbitt is a member of the Advisory Committee on Sanitary Engineering of the National Research Council.

Navy and Maritime Commission.--During 1935 and 1936, Professor Newmark was consultant to the Bureau of Yards and Docks of the U. S. Navy on special features of the structural design of a large floating dry dock. Recently he has been consultant to a builder of concrete cargo ships for the U. S. Maritime Commission. His work has been concerned with special features of the structural design of the hulls.

Civil Works Administration.--At the close of the year 1933 and the beginning of 1934, Professor W. C. Huntington was appointed by Governor Horner to take direct charge of forming an engineering organization to approve plans, purchase materials and equipment, and supervise construction for projects on which men on relief in the State of Illinois could be employed through the Civil Works Administration. Beginning as the only member of such a staff, on November 19, 1933, it was necessary for him to develop a state-wide organization with such speed that one hundred thousand men could be placed on the payrolls in two weeks from the time he was notified of his appointment and another one hundred thousand could be added by the end of the following two weeks. The number employed reach a peak of 226,000 on January 18, 1934, two months after Professor Huntington was appointed. At that time, the engineering staff numbered 1200. The total expenditures for labor up to April 15, 1934 were 53 million dollars and for materials 6 million dollars, making a total of 59 million dollars, not including the several million dollars spent by the public agencies for whom the work was done. By April 5, 1934 the number employed was reduced to 118,000 and from then on the program was brought to a close as rapidly as possible. The program was intended as a stop-gap to take care of the critical unemployment situation during the period while the slower-moving Public Works Administration (PWA) was getting underway. The Civil Works Administration organization in Illinois performed in an effective and creditable manner. By participating, as it did, the University rendered a valuable service to the State and Federal Government.

Caribbean Base.--The remote location of rock for concrete aggregate required for the U. S. Air Base at Hyde Park, British Guiana, South America, created a time hazard in the completion of runways. The availability of a beach sand at the air base site suggested the possibility of the use of this material in place of rock for the concrete used in taxi ways and parking strips and possibly for the runways themselves. Data were needed on the abrasive resistence and ultimate strength of the concrete produced by the use of the sand with Portland cement. Professor E. E. Bauer devised a unique type of test to determine abrasive resistance. A large sample of the sand was shipped to the University of Illinois laboratory and as a result of the test the material was used for parking strips and taxiways. This resulted in the saving of valuable time and considerable cost to the government.

d. Conferences and Short Courses

The civil engineering staff holds annual conferences and short courses to assist engineers and others in keeping up to date with developments in their fields.

The Annual Conference on Highway Engineering started in 1914 as a Short Course in Highway Engineering. These conferences are directed by Professor C. C. Wiley. During the period 1934 to 1942, two other conferences and two short courses have been inaugurated. The Annual Surveying Conference held in cooperation with the Illinois Society of Engineers was started in 1938. These conferences are directed by Professor W. H. Rayner. A Traffic Engineering Conference was started in 1941 with the intention that it be biennial. It was directed by Professor Wiley. This conference is sponsored jointly by the Department of Civil Engineering and the Illinois Division of Highways. The first Short Course for Water Treatment Plant Operators was held in 1940. The State Department of Public Health cooperates in this conference. These courses are directed by Professor H. E. Babbitt. The first Short Course for Sewage Treatment Works Operators was held in 1939. The State Department of Public Health cooperates in this course also. These courses are directed by Professor Babbitt.

The increase in the number of meetings of this type since 1934 show the progressive spirit which prevails in the staff. Such meetings are of considerable value to the engineers of the state and add to the University's prestige in the state.

4. COMPARISON OF PRODUCTIVITY AND PROFESSIONAL ACTIVITIES

a. Engineering Experiment Station Publications

for the Nine-Year Periods 1934-1942 and 1925-1933

An important index of research activity in the department is the number of publications of the Engineering Experiment Station. These are reports on major pieces of research which usually involve large expenditures of time and money. Most of the more expensive projects are carried on by cooperative agreements with agencies which pay the direct cost of the investigations. These are commonly public agencies or technical societies such as:

Public Roads Administration
Federal Works Agency

Bureau of Ships
U. S. Navy

The Division of Highways
of Illinois

Association of American Railroads

The American Society of Civil Engineers

San Francisco-Oakland Bay Bridge

Engineering Foundation

The American Welding Society

Portland Cement Association

The total amount received from outside sources for projects of the Engineering Experiment Station was $149,000 for the nine-year period 1934 to 1942 and $82,000 for the nine-year period 1925 to 1933. It is seen that those funds have nearly doubled in the last nine-year period. This is a very definite measure of the amount of organized research being carried on in the civil engineering department. Also, an examination of the publications resulting from this research will show conclusively that the quality has certainly been maintained. Actually there has been an improvement in this respect as would naturally be expected from the accumulated experience of those who are doing the work. One of the best measures of the quality of this research is the continuous support given by various agencies. All of this research is basic in character and in no case is money accepted for research which would promote the sale of any product. Any commercial aspect is carefully avoided.

Two members of the staff, Professors W. M. Wilson and N. M. Newmark, devote their time primarily to research but each teaches graduate classes and in that way makes important contributions to the instructional program. Members of the instructional staff devote a considerable amount of effort to research. This is evidenced by the publications Professors Babbitt, Pickels, Rayner, and Dell, which are listed under this heading, have contributed. It is also evidenced by many of the writings of staff members, which are listed later in this memorandum.

A definite atmosphere of research exists in the Civil Engineering Department. Without doubt, the Engineering Experiment Station organization contributes greatly to this. This phase of the organization is a very desirable one because the Station is not a separate entity but is open, without formal action, to all members of the staff who are interested in research. The active program of research carried on in close contact with instruction improves the quality of both. Through the Research Graduate Assistantships, the research program in the Station has a definite training value which might be considered as comparable to the value of the results of the research. This effect is evidenced by the outstanding records in research made by many who have served as such assistants.

The forward trend of the department in research is very definitely indicated by a comparison of the number of publications during the two periods under consideration, as listed in the following pages. For the nine-year period, 1934 to 1942, there were 24 Bulletins and 3 Circulars, making a total of 27 publications, while during the nine-year period, 1925 to 1933, there were 12 Bulletins and 1 Circular, making a total of 13. These data are for present members of the staff and indicate that the productivity of the staff has doubled during the last nine-year period. If the publications of all of the members of the staff for both periods are included the total from the period 1934 to 1942 would be increased by one Bulletin and from the period 1925 to 1933 by two Bulletins.

This trend of the department in research is still further emphasized by comparison with the preceding nine-year period 1916 to 1924 during which there were only three Bulletins and three Circulars published. Two of the Bulletins and the two Circulars were by Professor Wilson while one was by Professor Babbitt, who was not then a member of this department.

The number of Experiment Station publications by members of this department may be summarized as follows:

	All Members	Present Members
1916 to 1924	6	6
1925 to 1933	15	13
1934 to 1942	28	27

These data indicate quite conclusively that the increase in research activity in the department, as indicated by these publications, is very marked but an examination of the publications will show that this increase is even more marked because there has been a strong trend toward more extensive, more costly, and more significant research as the general program of research develops.

The publications of the Engineering Experiment Station by members of the civil engineering staff have had a pronounced effect on engineering practice. They have resulted in new design procedures and changes in old procedures. They form the basis for many design specifications and give basic data on which designs are based.

The Proceedings of the Annual Highway Conference, which are published as Circulars, are not included in this discussion. There have been seven of these all since 1934. These are not included in the foregoing tabulations.

Lists of the publications of the Engineering Experiment Station by members of the staff are given on the following pages.

PUBLICATIONS OF ENGINEERING EXPERIMENT STATION

1934 to 1942 inc.	1925 to 1933

By W. M. Wilson, Research Professor

Tests on Bearing Value of Large Rollers	Tests on Bearing Value of Large Rollers
Tests of Three-Span Reinforced Concrete Arch Ribs on Slender Piers (with R. W. Kluge)	Effect of Climatic Changes on a Multiple-Span Reinforced Concrete Arch Bridge
Tests of Three-Span Reinforced Concrete Arch Bridges with Decks on Slender Piers (With R.W.Kluge)	Rolling Tests of Plates
Effect of Time Yield in Concrete upon Deformation Stresses in Reinforced Concrete Bridge (with R. W. Kluge)	Laboratory Tests of Reinforced Concrete Arch Ribs
Effect of Residual Long. Stresses on Load-carrying Capacity of Steel Columns (with R. L. Brown)	Tension Tests of Rivets (with W. A. Oliver)
Tests of Steel Columns; Thin Cylindrical Shells; Laced Channels; Angles	Movement of Piers During Construction of Multiple-Span Reinforced Concrete Arch Bridge
Tests of Thin Hemispherical Shells Subjected to Internal Hydrostatic Pressure (with J. Marin)	Tests of Joints in Nide Plates (with J. O. Mather and C. O. Harris)
Fatigue Tests of Riveted Joints (with Frank P. Thomas)	Bearing Value of Pivot Scales (with R. L. Moore and E. P. Thomas)
Laboratory Tests of Reinforced Concrete Rigid Frame & Bridges (with R. W. Kluge)	Strength of Thin Cylindrical Shells as columns (with N. M. Newmark)
Fatigue Tests of Butt Welds in Structural Steel Plates (with A. P. Wilder)	Tests of Welds
Fatigue Tests of Correction Angles (with John V. Coombe)	

(Continued on next page)

1934 to 1942 inc.	1925 to 1933

By W. M. Wilson, Research Professor (cont.)

Fatigue Tests of Welded Joints in Structural Plates (with Bruckner, Coombe, Wilde)

Tests of Cylindrical Shells (with E. D. Olson)

Tests of Riveted and Welded Joints in Low Allow Structural Steels (with Bruckner and McCracken)

By N. M. Newmark, Research Assistant Professor

Strength of Monolithic Concrete Walls (with F. E. Richart) (Appointed in 1934)

A Distribution Procedure for the Analysis of Slabs Continuous Over Flexible Supports

Tests of Plaster-Model Slabs Subjected to Concentrated Loads (with H. A. Lepper)

Moments in I-Beam Bridges (with Chester P. Siess)

Simplified Computation of Vertical Pressures in Elastic Foundations

Influence Charts for Computations of Stresses in Elastic Foundations

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1934 to 1942 inc.	1925 to 1933 inc.
By H. E. Babbitt, Professor	
Mechanical Aeration of Sewage by Sheffield Paddles and by Aspirator	Tests on Hydraulics of House Plumbing Part II
Laminar Flow of Sludges in Pipes (with D. H. Caldwell)	Results of Tests of Sewage Treatment (with H.E. Schlenz)
Turbulent Flow of Sludges in Pipes (with D. H. Caldwell)	
By G. W. Pickels, Professor	
Magnitude and Frequency of Floods on Illinois Streams	Run-off Investigations in Central Illinois
By W. H. Rayner, Associate Professor	
Two Investigations of Transit Instruments	
By A. A. Brielmaier, Associate	
German-English Glossary of Civil Engineering	(Appointed 1937)
By Hardy Cross, Professor (Resigned 1937)	
Analysis of Flow in Networks of Conduits and Conductors	Dependability of the Theory of Concrete Arches
	Column Analogy
By George H. Dell, Assistant Professor	
Effects of Errors on Variations in Arbitrary Constants of Simultaneous Equations	

b. Technical Book Writing

For the Nine-Year Periods 1934-1942 and 1925-1933

The present members of the civil engineering staff have been active in the writing of technical books. Probably no other present civil engineering staff in the country has written as many. These books cover nearly all phases of civil engineering including materials, surveying, highways, water supply, sewage, drainage, bridges, and buildings, and indicate a well balanced program in the department. All of these books have been well received and most of them have won positions or leaders, or among the leaders, in their respective fields.

Three factors enter into the appraisal of one's book writing activity. The first factor is, of course, that he must write; the second, that the book be of high quality; and the third that it be kept abreast the times by revision. It is to be expected that, after one writes a book, he will devote his energies available for such work to keeping the book up-to-date if the book is successful. During the nine-year period from 1925 to 1933, six books were written by present members of the staff and three books were revised. During the following nine-year period from 1934 to 1942, three books were written and nine were revised. This is in accordance with the natural trend mentioned above. These data do not include books for which members of the staff were junior authors with members of the staffs of other institutions or books to which they contributed chapters or sections. There have been several such contributions during both periods.

The data presented show that the department has been very active in book writing and that this activity has continued through both periods in question. That the staff will continue its productivity in book writing beyong the year 1942 is evidenced by the fact that the manuscript for a book on "Earth and Masonry Structures" by W. C. Huntington is far advanced and a contract for publication has been entered into with John Wiley and Sons; a large amount of work has been done by Professor J. J. Doland on a book on "Water Power Engineering" and a contract for publication has been signed with John Wiley and Sons. An agreement has been reached between Professor T. C. Shedd and John Wiley and Sons for a book on "Bridge Design", the manuscript for which is well under way; and the manuscript for a book on "Soil Testing" by Professor E. E. Bauer is nearly complete although no arrangement has yet been made for publication.

TECHNICAL BOOK WRITING

1934 to 1942 inc.

New Books

Elementary Surveying
W. H. Rayner, D. Van Nostrand

Advanced Surveying
W. H. Rayner, D. Van Nostrand

Structural Design in Steel
T. C. Shedd, John Wiley & Sons

Revisions

Drainage and Flood Control Engineering
G. W. Pickels, McGraw-Hill Co.

Building Construction
W. C. Huntington,
John Wiley & Sons

Theory of Simple Structures
T. C. Shedd and Jamison Vawter
John Wiley & Sons

Sewage and Sewage Treatment
H. E. Babbitt, John Wiley & Sons

Water Supply Engineering
H. E. Babbitt and J. J. Doland
McGraw-Hill Book Co.

Plain Concrete
E. E. Bauer, McGraw-Hill Book Co.

Principles of Highway Engineering
C. C. Wiley, McGraw-Hill Book Co.

Route Surveying
G. W. Pickels and C. C. Wiley
John Wiley & Sons

Highway Materials
E. E. Bauer, McGraw-Hill Book Co.

1925 to 1933 inc.

New Books

Principles of Highway Engineering
C. C. Wiley, McGraw-Hill Book Co.

Water Supply Engineering
H. E. Babbitt and J. J. Doland
McGraw-Hill Book Co.

Plumbing
H. E. Babbitt, McGraw-Hill Co.

Plain Concrete
E. E. Bauer, McGraw-Hill Book Co.

Highway Materials
E. E. Bauer, McGraw-Hill Book Co.

Theory of Simple Structures
T. C. Shedd and Jamison Vawter
John Wiley & Sons

Revisions

Sewage and Sewage Treatment
H. E. Babbitt, John Wiley & Sons

Route Surveying (formerly Railroad Surveying)
G. W. Pickels and C. C. Wiley
John Wiley and Sons

Drainage and Flood Control Engineering
G. W. Pickels, McGraw-Hill Book Co.

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c. Technical Papers, Articles, and Reports

for the Nine-Year Periods 1934-1942 and 1925-1933

The following pages list the papers, articles, and reports by present members of the staff for the two periods being considered. All of the documents in these classes as listed by members of the staff in the annual Record of General Activities, compiled for the Dean, are included for comparative purposes although it must be realized that some of the papers are the result of many months or even years of study while others required relatively little effort to prepare. This comment applies to both periods. However, the complete list as given serves as one means of comparison of the activities of members of the staff. The three associates in the department are not included in this list although they have done some writing. Two of these men are studying toward the doctor's degree and have devoted all of their available time to graduate study and work on their doctor's theses. Certainly one, and possibly both, of these theses will develop into a Bulletin of the Engineering Experiment Station.

An examination of the following pages will show that members of the civil engineering staff have been active in writing papers, articles, and reports covering practically all phases of civil engineering. Also, it will be seen that this activity during the last nine-year period is about double that during the preceding nine-year period. This increase would naturally be expected as the staff members develop and merely serves to indicate that development is taking place. Certainly there is no indication of decrease in productivity. The actual number of articles in each period is of no great significance. However, the total number of articles in each period is as follows:

	All Members	Present Members
1925 to 1933	77	65
1934 to 1942	128	122

1934 to 1942 inc. 1925 to 1933 inc.

By W. C. Huntington, Head of Department

Discussion: Reduction Method for Analysis of Continuous Beams and Open Frames
Jour. Am. Concrete Inst. 1938

Structural Engineering Section
American Year Book, 1934 to 1938

Memoir of Milo S. Ketchum
Trans., A. S. C. E., Vol. 102 (1937)

A New Type of Pressure Cell for Granular Materials
Engr. News-Record, 1936

Section on Bridges
1936 Ed. Nelson's Encyclopedia

Section on Dams
1936 Ed. Nelson's Encyclopedia

Revision of Civil Engr. Terms in Webster's Dictionary, 1934 Ed.
Under general direction of M. S. Ketchum

Editor, Big Muddy Basin Report for Ill. Emergency Relief Commission

Editor, Kaskaskia Valley Report for Ill. State Planning Commission

Report on Expansion Joints in Concrete Pavements for Governor of Illinois

Report of Committee on Constr. Engr. Ed. Proc., A.S.C.E. 1936

(Appointed 1926)
Discussion: Wind-Bracing Connection Efficiency by V. T. Berg
Trans., A. S. C. E. 1933

Discussion: Principal Stresses in Buttresses and Gravity Dams by W. H. Holmes.
Trans., A. S. C. E. 1933

The Construction Engineer
Civil Engineering, 1933

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1934 to 1942 inc.

By H. E. Babbitt, Professor

Mechanical Aeration of Sewage
Water Works and Sewage, 1934

Research in Sewage Treatment
Municipal Sanitation, 1935

Disposal of Garbage and Sewage Sludge, Sewage Works Journal, 1935

The Dosing of Sewage Tanks with Ground Garbage, Sewage Works Journal, 1936

The Educational Situation in Water Works, Journal of Am. Water Works Ass'n., 1936

Some Recent Developments in Water Works Practice,
Journal Am. Water Works Ass'n. 1937

Trend and Developments in Water Purification Practice,
Bul. Ass'n. Engr. Journ., 1937

Solution of Transmission Problems of a Water System, Discussion,
Proc., A. S. C. E., 1937

Training the Sanitary Engineer
Jour. Am. Water Works Ass'n. 1938

Some Recent Developments in Water Works Practice
Jour. Am. Water Works Ass'n. 1938

(Continued on next page)

1925 to 1933 inc.

Plans for Plumbing Research, 1925
Jour. Ill. Master Plumbers Ass'n.

Tests on Plumbing at the U. of I.
Jour. Ill. Mast. Plumbers Association, 1926

Engineering Conditions in Hawaii
Engineering News-Record, Vol.104

Water Supply and Sewage of Large Japanese Cities, Engineering News-Record, Vol. 104

Public Works in Australia
Engineering News-Record, Vol. 106

The Sewage Farm at Melbourne
American City, Vol. 43

Control of Nile for Irrigation
Engr. News-Record, Vol. 105

Public Works of New Zealand
Engr. News-Record, Vol. 105

Public Water Supplies in British Indies,
Engr. News-Record, Vol. 105

Public Health in Manila
Engr. News-Record, Vol. 105

World Engineering Congress
Illinois Engineer, Vol. 6

Public Works in Indo-China
Engr. News-Record, 1931

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1934 to 1942 inc. 1925 to 1933 inc.

By H. E. Babbitt, Professor (cont.)

Note: Professor Babbitt was on a tour around the world in the school year 1929-30 and wrote a series of articles for the Engineering News-Record concerning this trip. He wrote individual articles for other publications. This accounts for the large number of articles during 1925 to 1933 inclusive.

Municipal Engineering in Singapore
Engr. News-Record, 1931

Irrigation in Java
Engr. News-Record, 1931

Registration of Engineers
Illinois Engineer, 1933

Inspection Trips
Jour. Soc. Pro. Engr. Ed., 1932

By Wilbur M. Wilson, Research Professor

Design of Connection Angles for Stringers of Railroad Bridges
Bulletin A.R.E.A., 1940

Recent Developments in Structural Welding
Jour. West. Soc. of Engrs., 1937

Relation of Research to Teaching
Jour. of Am. Welding Soc., 1937

Application of Wedge Extensometer
Proc., A.S.T.M., 1936

Tests to Determine Feasibility of Welding Steel Bldg. Frames
Jour., Am. Weld. Soc., 1936

Present Status of Welding
Jour. West. Soc. of Engr., 1936

Bearing Value of Large Rollers
Bul., Am. Railway Engr. Ass'n. 1935

Flexual Strength of Short Beams
Bulletin, A.R.E.A., 1933

Strength in Bearing of Webs for Rolling Bascule Bridges
Bulletin, A.R.E.A., 1933

Importance of Wind Bracing Connections, Civil Engr., 1931

Some Questions on Design of Weighing Machines
Scale Journal, 1930

Moments in Restrained and Continuous Beams
Proc., A.S.C.E., 1926

Opportunities in Engr. Research
Iowa Engineer, 1925

1934 to 1942 inc. 1925 to 1933 inc.

By John S. Crandell, Professor

Report on Brick Pavements
Highway Research Board, 1940

Report on Filling and Sealing Expansion Joints
Highway Research Board, 1940

Filling and Sealing Expansion Joints
American Highways, 1940

Build Two-Lane Pavements, Not One-Lane
Better Roads, 1940

Trim Vegetation at Dangerous Corners
Better Roads, 1940

Build Highways Straight
Better Roads, 1940

Shorten the Data on Historical Markers
Better Roads, 1940

Why Spend Fabulous Sums for Unused Lanes
Better Roads, 1940

Good Rules of Safety.... Necessary on Highways
Better Roads, 1941

Tractors with Lugs Prohibited
Better Roads, 1941

Parking Lots Cheaper than Parking Strips
Better Roads, 1941

(Appointed 1926)
Fillers for Brick and Block Pavements
Proc., Highway Res. Board, 1933

Simple Safeguard for Night Drivers
Engr. News-Record, 1933

Fillers and Bedding Courses for Block Pavements
Proc., Highway Res. Board, 1932

Building Low-Cost Base for a Low-Cost Road
Engr. News-Record, 1932

Research on Fillers
Road and Streets, 1933

Resurfacing Illinois Highways
Municipal Index, 1932

Fillers and Bedding Course for Block Pavements
Proc., Highway Res. Board, 1936

Fillers and Bedding Course for Block Pavements
Proc. Nat. Paving Brick Assn.1932

Brick Fillers and Bedding Courses
American City, 1931

Fillers and Cushion Courses for Block Pavements
Proc. Highway Res. Board, 1930

Fillers for Brick Pavements,
Proc., Nat. Paving Brick Manufacturers Ass'n., 1931

(Continued on next page)

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1934 to 1942 inc. 1925 to 1933 inc.

By John S. Crandell, Professor (cont.)

Report of Com. on Fillers
Proc., Highway Res. Board, 1938

Erosion Control in Illinois
Proc., Highway Res. Board, 1938

Patching Bituminous Roads
Better Roads, 1940

Maintenance
Better Roads, 1940

Stabilizing Sub-Grades
Better Roads, 1940

Filling Joints and Cracks in
Concrete Pavements
Better Roads, 1940

Methods of Vibration of Concrete
According to French Practice
Proc. Highway Res. Board, 1937

Report of Committee on Fillers
Proc., Highway Res. Board, 1937

Fillers for Brick and Block Pavements
Roads and Constr. (London) 1939

Report on Fillers for Block Pavements
Int. Road Cong., Brussels, 1939

Development of Brick Pavements
in the United States
Public Roads, 1938

Express Road and the Highway System
Civil Engineering, 1937

Germany Builds Super-Highways
Engr. News-Record, 1936

No Need of Faults in Brick Pavements
American City, 1936

Resurfacing Old Brick Pavements
Highway Engr. and Contractor 1931

Parking
Illinois Engineer, 1929

The Twenty-Four Hour Street
Literary Digest, 1928
American City, 1927

(Continued on next page)

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Property Exhibits, and Records

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1934 to 1942 inc. 1925 to 1933 inc.

By John S. Crandell, Professor (cont.)

New Sense of Design Values Needed
Engr. News-Record, 1937

Industrial Studies in Regional Planning
Planners' Journal, 1936

A Touring Engineer's Impression of Roads of Italy
Engr. News-Record, 1935

Roadside Bins for Maintenance Materials in Switzerland
Better Roads, 1933

Report on Brick & Block Pavements
Proc., Highway Res. Board, 1935

Resurfacing
Roads and Streets, 1934

Bituminous Joint Compounds for Sewer Pipe
Am. Soc. Testing Materials, 1934

By Thomas C. Shedd, Professor

Discussion: Effective Moment of Inertia of Riveted Plate Girder
Trans., Am. Soc. C. E., 1940

Discussion: Moment of Distribution by Hardy Cross
Proc., American Society of Civil Engineers, 1931

The Eads Bridge
Bulletin, Assoc. Engr. Soc. 1930

Discussion: Secondary Stresses in Bridges
Proc., Am. Soc. C.E., 1925

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1934 to 1942 inc.	1925 to 1933 inc.

By James J. Doland, Professor

Section on Structural Engr. (Appointed 1926)
American Year Book, 1939 to 1941 inc.

Flow and Loss of Head in Distribution Systems
Jour. Am. Water Works Ass'n. 1941

Low Dams, Co-editor with N. W. Horner
National Resources Committee

Model Study of Spillway Characteristics
Circ. 20, Ill. State Water Survey

Revisions of Drainage Basin Studies for Upper Mississippi River
National Resources Committee

Simplified Analysis of Flow in Water Distribution Systems
Engr. News-Record, 1936

General Summary Reports on Water Resource Developments for Nine River Basins
National Resources Committee, 1936

Flow over Rounded Crests
Engr. News-Record, 1935

Design Method for Large Monolith Siphons
Engr. News-Record, 1936

Water Supply Section, General Engineers Handbook
McGraw-Hill Book Co., 1931

Return Flow of Irrigation Water
Reprint to War Department

Dam Construction by U. S. Reclamation Bureau
Bul., Assoc. Engr. Soc. 1927

By George W. Pickels, Professor

Three Sections in Report on Big Muddy Basin
Ill. Soc. of Engrs., 1935

Two Sections in Report on Kaskaskia Basin
Ill. State Planning Commission

Engineering Aspect of Land Drainage in Illinois
Ill. State Geological Survey

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1934 to 1942 inc.	1925 to 1933 inc.

By Jamison Vawter, Professor

Reports on Foundations, 1938, 1939, 1940, and 1942
Masonry Com., A.R.E.A.

Bibliography on Foundations
Am. Railway Engr. Ass'n., 1942

Discussion: Design of Concrete Arches
Trans., A.S.C.E., 1925

By Carroll C. Wiley, Professor

Highway Financing in Illinois
Ill. Tax Commission, 1940

Financing of Municipal Improvements
Ill. Municipal Review, 1941

The Bugbear of Spirals
Engr. News-Record, 1939

Twenty-Six 500-word Articles on Highways, Published variously by Ill. Dept. of Public Information

Yesterday and Today with Police
Ill. Police Benev. & Prot. Ass'n.

Report on Automobile License Plates for Secretary of State

Discussion: Estimating Economic Value of Prop. Hy. Exp.
Trans, A.S.C.E., 1934

Roads, Traffic, and Engineers
Proc., Annual Highway Conf.
Circ. 33, Engr. Exp. Sta., 1938

Traffic Signals
Proc., Annual Highway Conference
Circ. 30, Engr. Exp. Sta., 1937

Report on Armington Pavement for Illinois Division of Highways

Road Signs for Night Driving
Roads and Streets, 1933

Some Economic Phase of Pavement Resurfacing
Ill. Municipal Review, 1930

Effect of Temperatures on Strength of Concrete
Engr. News-Record, 1929

Maintaining Concrete Pavements
Municipal and County Engr., 1925

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1934 to 1942 inc.	1925 to 1933 inc.

By William H. Rayner, Associate Professor

Surveying in Ancient Times
Civil Engr., Oct. 1939

From Columbus' Compass to First Transit
Civil Engineering, Nov. 1939

Recent Developments in Surveying Practice
Bul., Assoc. Engr. Soc., 1938

Discussion: Adjustment of Level Net
Proc., Am. Soc. C.E., 1935

Fourth-Order Triangulation on Illinois River
Illinois Engineer, 1933

The Telescopes of Surveying Materials
Illinois Engineer, 1931

Specifications for Transit Surveying and Stadia Leveling
Trans., A.S.C.E., 1930

Present Status of Aerial Surveying
Illinois Engineer, 1928

By William A. Oliver, Assistant Professor

Glued Laminated Wood Beams Impregnated with Creosote
Proc., A.S.T.M., 1942

Modern Developments in Timber Construction
Bul., Assoc. Engr. Soc., 1938

Stress Theory and Fact Checked on Glued Timber Arches
Engr. News-Record, 1937

Teaching Theory of Flexure in Reinforced Concrete
Bul., C.E. Div., S.P.E.E., 1937

Exp. Study of Load Distribution to Stringer's in Timber Floor Panel
Bul., A.R.E.A., 1933

Appointed 1929

Modern Framed Structures, A Review
Illinois Engineer, 1930

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By E. E. Bauer, Assistant Professor

A Study of Deflocculating Agents
Proceedings, A.S.T.M. 1938

Hydrometer Computations in Soils Simplified
Engr. News-Record, 1937

Chemical Aspects of Manufacture and Use of Cement
Roads and Streets, 1937

Manufacture and Use of Portland Cement
Roads and Streets, 1937

Variations in Heating Affect Asphalt Penetration Tests
Civil Engineering, 1936

Determination of Moisture in Soil Samples without Drying
Bul. A.S.T.M., 1936

Building Street Intersections without Bumps
American City, 1936

Instruction in Soil Mechanics
Prof., Int. Conf. on Soil Mechanics, 1936

High-Early Strength Concrete
Proc. Am. Concrete Inst. 1929

Rational Design of Bonding Steel in Concrete Roads
Engr. News-Record, 1927

Opening Concrete Roads to Traffic
Roads and Streets, 1927

Discussion: Relation of 7-day to 28-day Compressive Strength by Slater
Proc., Am. Con. Inst., 1926

Discussion: Field Tests of Concrete
Proc., Am. Soc. C. E., 1925

Comparison of Parabola and Circle for Pavement Crowns
Engr. News-Record, 1925

1934 to 1942 inc. 1925 to 1933 inc.

By Nathan M. Newmark, Research Assistant Professor

Monolithic Concrete Walls for Dwellings (Appointed 1934)
Proc., Am. Concrete Inst., 1935

Discussion: Analysis of Multiple Arches by A. Herennikoff
Proc., A.S.C.E., 1936

Half-Century of Progress in Foundation Theory
Ill. Soc. of Engrs., 1936

Strength Tests of Monolithic Concrete Walls (with R. E. Copeland)
Concrete, 1936

Discussion: Distribution of Stresses Under a Foundation by A. Cummings
Proc., A.S.C.E., 1936

Discussion: Relation of Analysis to Structural Design by H. Cross
Trans., A.S.C.E., 1936

Intersection Between Rib and Superstructure of Concrete Arch Bridges
Trans., A.S.C.E., 1938

Discussion: Vertical Pressures Beneath Foundations by D. M. Burmister
Trans., A.S.C.E., 1937

Estimating Earth Pressures
Engr. News-Record, 1938

Discussion: Computation of Temperatures in Concrete Structures by R. W. Carlson
American Concrete Institute, 1938

Discussion: Continuous Beams and Open Frames by M. Hetenyi
Proc., Am. Concrete Inst., 1938

Stress Distribution in Soils
Proc., Conf. on Soil Mech.
Purdue University, 1940

(Continued on next page)

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1934 to 1942 inc. 1925 to 1933 inc.

By Nathan M. Newmark (cont.)

What Do We Know About Concrete Slabs?
Civil Engineering, 1940

Influence Surfaces in Plates by Use of Different Equations
Jour. Applied Mechanics, 1941

Computing Deflections, Moments and Buckling Loads, Proc., A.S.C.E. 1942

By George H. Dell, Assistant Professor

(Appointed 1928)

Discussion: Miniature System of First Order Alignment, etc. by Hough
Proc., A.S.C.E., 1940

Discussion: Solution of Equations in Structural Analysis, etc. by Dell
Trans., A.S.C.E., 1940

Discussion: An Improved Method for Adjusting Surveys, by Norris and Speert
A.S.E.C., 1940

Square Root by Successive Approximations
Civil Engineering, Vol. 8

Graphics for Vertical Curves
Engr. News-Record, 1938

Calculating Volume of a Truncated Spherical Segment
Civil Engineering, Vol. 9

The Adjustment of a Level Net
Trans., A.S.C.E., 1936

Effects of Instrumental Errors, etc.
Bul., Assoc. Engr. Soc., 1930

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d. Committees of Technical Societies

for the Nine-Year Periods 1934-1942 and 1925-1933

Evidence of the trend of the Civil Engineering Department for the years 1934 to 1942 can be gained by comparing the membership and activities of members of the staff in the affairs of national and state technical societies for that nine-year period with corresponding data for the preceding nine-year period.

On the following pages are given tabulations of society memberships in 1933 and 1942 followed by lists of the committees of these societies on which members of the staff have served during the nine-year periods 1934 to 1942 and 1925 to 1933. No committee records are included for Messrs. Evans, Drielmaier, and Clark, who are associates. They have served on few committees largely because of the time devoted to graduate study.

The primary source of information from which these data have been compiled is "The Record of General Activities", a form each staff member fills out each year for the records of the Dean of Engineering. On this blank, he expects each staff member to give complete information concerning all of the technical committees on which he is serving for the current year. No effort is made to distinguish between the importance of these committees. Since the present report is for comparative purposes, all of the committees listed by each staff member during each nine-year period are given so the records for the two periods will be compiled on the same basis. They include committees and sub-committees. If a staff member has been chairman of the committee at any time during the nine-year period, he is listed as being chairman although he may or may not have been chairman for the entire nine-year period. Society offices held are included. Other sources of information are the "Annual Reports" of the Department which do not vary much, in this respect, from the Record of General Activities because the latter is used in preparing the former. Each member of the staff has examined the data which refer to him and has stated that they are correct.

In examining this material, it should be kept in mind that some of the societies have increased their committee activity during recent years and that this would naturally be reflected in the number of staff members serving on committees. However, it is certain that this factor could only partially offset the large increase in committee activity by members of the staff.

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Serving on the committees of technical societies is considered to be an important factor in the quality of the instruction, writing and research done by members of the staff. It keeps them in touch with the developments in their various fields and encourages participation in such developments. It promotes acquaintance with other engineers and gives them information concerning the work being done by the department. Comments and criticisms of committee members on reports submitted by staff members contribute to the value of reports on research projects or other procedures followed in any study. The appointment of a staff member to a committee is a recognition by his associates that he is qualified to contribute to the work of the committee and is, therefore, a recognition of the work being carried on by the department.

In order to serve on committees, it has been necessary for staff members to attend meetings of the societies. Their attendance at such meetings has been noteworthy. This has involved large expenditures for traveling expenses, which with rare exception, have been paid by the staff member because the University does not pay such expenses, even in cases where they present papers, and the societies do not often pay such expenses. Since most meetings are held at a considerable distance from Urbana, the cost of travel is especially large for members of this staff.

An examination of the data presented will show quite conclusively that the members of the staff of this department are active in nearly every phase of civil engineering work and that their activity has been increasing through the years.

By consulting the membership tabulation on the following page it will be seen that every member of the staff is a member of the American Society of Civil Engineers, the leading national society in his general field. Also it will be seen that staff members belong to many other national societies representing his special interests and to the state society.

The total number of technical societies to which staff members belong is 20, the total number of memberships is 76, and the average per member is 4.5. This does not include Sigma Xi. Nearly all of the members of the staff belong to these societies.

The number of offices and committee memberships held by members of the staff for the two periods being compared is:

	All Members	Present Members
1925 to 1933	98	88
1934 to 1942	196	187

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MEMBERSHIP IN TECHNICAL SOCIETIES

Name	Joined staff since 1934	Am. Soc. of Civil Eng.	Soc. for Prom. of Eng. Education	Am. Railway Eng. Ass'n.	Am. Soc. for Testing Materials	Am. Concrete Institute	Western Soc. of Eng.	Am. Water Works Ass'n.	Illinois Soc. of Engineers	Am. Public Health Ass'n.	Asphalt Paving Technologists	Am. Road Building Ass'n.	Am. Assoc. for Adv. of Science	Am. Geophysical Union	International Ass'n. Bridge & Struct. Eng.	Central States Sewage Works Ass'n.	Illinois Public Health Ass'n.	National Soc. of Professional Eng.	Regional Plan Ass'n. of N. Y.	Am. Society of Photogrammetry	Institute of Traffic Engineers	Total Memberships
H.E. Babbitt		3	3					3	3	3						2	2	2				8
E.E. Bauer		3	2		3	3			1													7
A.A. Brielmaier	x	2				2																2
J.G. Clark	x	2																				2
J.S. Crandell		3			3	1			2		3	3							2			7
G.H. Dell		3	3			2			2													5
J.J. Doland		3	1					3					2	2								5
H.P. Evans	x	2	2																			4
W.C. Huntington		3	3		3	2	3		3						2							6
N.W. Newmark	x	2				2																3
W.A. Oliver		3	3	3	3													2				5
G.W. Pickels		3	3					2	3					3				2				5
W.H. Rayner		3	3																	2		4
T.C. Shedd		3	3	2					3													4
J. Vawter		3	3	3																		2
C.C. Wiley		3	2						3			2									2	5
W.M. Wilson		3	3	3	3	2	3		3				3		3							8
Total Memberships		17	13	4	5	7	2	3	10	1	1	2	2	2	2	1	1	3	1	1	1	79

1 - Member in 1934; 2 - Member in 1942; 3 - Member in 1934 and 1942

This table does not include Sigma Xi or Tau Beta Pi. Most of staff are members.

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W. C. Huntington — Head of Department — Appointed 1926

1934 to 1942 inc.	1925 to 1933 inc.
Chairman, Engr. Advisory Board Civil Works Admin. for Illinois	(Appointed 1926) Chairman, Engr. Advisory Board Civil Works Admin. for Illinois
V. Chairman, Work Relief Ill. Emergency Relief Admin.	Committee on Professional Rela. Illinois Society of Engineers
Chairman, Construction Education Const. Division A.S.C.E.	Committee on Student Chapter Central Ill. Sec. A.S.C.E.
Chairman, Committee on Const. Civil Engr. Div., A.S.C.E.	Member of Council Soc. for Promotion of Engr. Ed.
Chairman, Structural Engr. Sec. Illinois Society of Engineers	Committee on Lammc Award Soc. for Promotion of Engr. Ed.
Chairman, Big Muddy Basin Com. Ill. Engr. Relief Commission	Chairman, Committee on Const. Ed. Construction Division, A.S.C.E.
Chairman, Kaskaskia Basin Com. Ill. State Planning Commission	Student Award Committee Cent. Ill. Sec., A.S.C.E.
Member Board of Trustees Western Society of Engineers	
Chairman for Illinois American Engineering Council	
Chairman, Merger Com. with W. Soc. Engr. Illinois Society of Engineers	
Chairman, Committee on Awards Western Soc. of Engineers	
Chairman, Com. on Expansion Joints for Governor of Illinois	
Chairman, Prof. Affairs Com. Illinois Society of Engineers	
Chairman, Subcom. on Spread Footings American Standards Association	
Chairman, Prof. Affairs. Com. Illinois Society of Engineers	
Civil Service Ex. Com. for Chief Engr., Chicago Park Dist.	

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1934 to 1942 inc.	1925 to 1933 inc.
V. Pres., Cent. Ill. Section American Society of Civil Engr.	
Pres., Cent. Ill. Section American Soc. of Civil Engineers	
Education Committee Western Society of Engineers	
Chairman, Public Relations Com. Illinois Soc. of Engineers	
Legislative Committee Illinois Soc. of Engineers	
Awards Committee Illinois Soc. of Engineers	
Chairman, Committee on Awards Ill. Sec., Am. Soc. of Civil Engr.	
Upper Mississippi Basin Com. National Resources Planning Board	
Committee of Excavations and Foundations American Standards Association	

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Wilbur M. Wilson Research Professor Appointed 1921

1934 to 1942 inc.	1925 to 1933 inc.
Com. on Iron & Steel Structures Am. Railway Engr. Ass'n.	Com. on Iron & Steel Structures Am. Railway Engr. Ass'n.
Ex. Com. Structural Division Am. Soc. of Civil Engineers	Chairman, Sub-Com. on Bearing Value of Large Rollers, A.R.E.A.
Chairman, Ex. Com. for Licensing Structural Engrs., State of Ill.	Com. on Concrete & Reinforced Concrete Arches, A.S.C.E.
Special Committees Impact American Railway Engineers Association	Chairman, Membership Com. for Central Illinois Section, Am. Soc. of Civil Engineers
Com. on Alloy & Heat Treated Steel Structural Div., A.S.C.E.	Chairman, Sub-Com. on Strength of Bridge Pins, A.R.E.A.
Com. on Flame Cutting Structural Div., A.S.C.E.	Chairman, Ex. Com. for Licensing Structural Engrs., State of Ill.
Com. on Fundamental Research American Welding Society	Secretary, Ex. Com., Structural Division, Am. Soc. of Civil Engrs.
Com. on Steel, Structural Div. Am. Soc. of Civil Engineers	Com. on Steel, Structural Div. Am. Soc. of Civil Engineers
Com. on Fundamentals Controlling Struct. Design, Struct. Div. Am. Soc. of Civil Engineers	Chairman, Structural Division Illinois Society of Engineers
Chairman, Com. on Struct. Alloys Struct. Div., A. S. C. E.	Com. on Alloy & Heat Treated Steel Struct. Div., Am. Soc. of C. E.
Vice-President, Cent. Ill. Sec. American Society of Civil Engrs.	Com. on Flame Cutting, Struct.Div. Am. Soc. of Civil Engineers
President, Cent. Ill. Sec. American Society of Civil Engrs.	Yards and Terminals American Railway Engineer. Ass'n.
Com. on Concrete Arches American Concrete Institute	Building Codes American Welding Society
Sub-Com., Fatigue Tests and Bridge Design, A. R. E. A.	Import on Concrete American Concrete Institute
Technical Procedure Com. Struct. Div., A. S. C. E.	

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Wilbur M. Wilson - page 2

1934 to 1942 inc.	1925 to 1933 inc.
Committee on Professional Objectives Illinois Society of Engineers	
Committee on Education American Welding Society	
Committee on Welded Bridges American Welding Society	
Research Com. on Fatigue of Metals American Soc. of Testing Materials	

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H. E. Babbitt Professor Appointed 1931

1934 to 1942 inc.	1925 to 1933 inc.
Secretary Illinois Society of Engineers	Secretary Illinois Society of Engineers
Editor, Illinois Engineer Illinois Society of Engineers	Editor of Proceedings Year Book Assoc. Engr. Soc.
President Associated Engineering Soc.	Editor, Illinois Engineer Illinois Society of Engineers
Director National Soc. of Prof. Engrs.	President Associated Engineering Societies
Licensing Committee American Water Works Ass'n.	President Illinois Society of Engineers
Joint Plumbing Committees American Water Works Ass'n., American Public Health Ass'n.	Committee on Plumbing Associated Engineering Society
Foreign Water Works Committee American Water Works Ass'n.	Foreign Water Fillers American Water Works Ass'n.
Local Committee Central States Sewage Works Ass'n.	Committee on Sludge American Soc. of Civil Engineers
Civil Engr. Division Committee Soc. for Promotion of Engr. Ed.	Committee on Abstracts American Water Works Ass'n.
Public Affairs Committee National Soc. of Prof. Engr.	Legislative Committee Illinois Section, Am. W. W. Ass'n.
Chairman, Sub-com. on Research Civil Engr. Div. of S.P.E.E.	Water Works Schools Ill. Section, Am. Water Works Ass'n.
Chairman, Sanitary Engr. Div. Soc. for Promotion of Engr. Ed.	Trustee, Illinois Section American Water Works Ass'n.
Committee on Abstracts American Water Works Ass'n.	
Publication Committee Associated Engr. Societies	
Director, Illinois Section American Public Health Ass'n.	

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H. E. Babbitt - page 2

1934 to 1942 inc.	1925 to 1933 inc.
Com. on Resolutions, Ill. Sec. American Water Works Ass'n.	
Program Committee Central States Public Health Ass'n.	
Program Committee Sanitary Engr. Div. A.S.C.E.	
President Central States Sewage Works Ass'n.	
President Ill. Public Health Ass'n.	
National Director American Water Works Ass'n.	
Chairman, Legislative Committee Ill. Sec., Am. Water Works Ass'n.	
Advisory Com. on Sanitary Engr. National Research Council	
Research Committee Federation of Sewage Works Ass'ns.	

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John S. Crandell — Professor — Appointed 1926

1934 to 1942 inc.	1925 to 1933 inc.
Chairman, Project Committee Brick and Block Pavements Highway Research Board	(Appointed 1926) Committee on Highway Safety Highway Research Council
Material and Constr. Com. Highway Research Board	Chairman, Maintenance Committee Highway Research Board
Bituminous Waterproofing and Roofing Materials Committee American Society for Test. Materials	Sewer Pipe Joints American Society for Testing Materials
Chairman, Waterproofing for Sewer Pipe Joints Am. Soc. for Testing Materials	Fillers for Brick Pavements Highway Research Board
Chairman, Com. on Fillers Asphalt Paving Technologists Ass'n.	Chairman, Highway Committee Ill. Soc. of Engineers
Project Committee Asphalt Paving Technologists Ass'n.	Developments in Brick Pavements American Road Builders' Ass'n.
Maintenance Committee Highway Research Board	Chairman, Project Committee Highway Research Board
Chairman, Proj. Com. on Fillers Highway Research Board	Chairman, Committee on Fillers Asphalt Paving Technical Ass'n.
Roads & Paving Materials Com. Am. Soc. for Testing Materials	Joints in Concrete Pavements Highway Research Board
Committee on Gravel Highway Research Board	
Soils for Engr. Purposes Com. Am. Soc. for Testing Materials	
Roads & Paving Materials Com. Am. Soc. for Testing Materials	
Emulsion Tests Committee American Soc. for Testing Materials	
Committee on Brick & Block Pavements Am. Soc. for Testing Materials	

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John S. Crandell - page 2

1934 to 1942 inc.	1925 to 1933 inc.
Emulsified Asphalts Committee Am. Soc. for Testing Materials	
Expansion Joint Materials Com. Am. Soc. for Testing Materials	
Joints in Concrete Pavements Highway Research Board	
Committee on Drain Tile Am. Soc. of Civil Engineers	
Committee on Expansion Joints for Governor of Illinois	
Maintenance of Bituminous Roads, etc. Committee Highway Research Board	
Salvaging High Type Flexible Pavements Committee Highway Research Board	
Com. C-2 of D-4 Coal Tar Products Am. Soc. for Testing Materials	

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George W. Pickels — Professor — Appointed 1907

1934 to 1942 inc.	1925 to 1933 inc.
President Illinois Society of Engineers	Vice President, Cent. Ill. Sec. American Soc. of Civil Engineers
Local Membership Committee Am. Soc. of Civil Engineers	Secretary, Cent. Ill. Section Am. Soc. of Civil Engineers
Dynamics of Streams Com. American Geophysical Union	Chairman, Drainage Section Illinois Society of Engineers
Executive Committee Illinois Society of Engineers	President, Cent. Ill. Section Am. Soc. of Civil Engineers
Chairman, Drainage Section Illinois Society of Engineers	Dynamics of Streams American Geophysical Union
Welfare Committee Illinois Society of Engineers	Director Illinois Society of Engineers
Great Lakes Drainage Com. National Resources Plan. Board	Committee on Welfare Illinois Society of Engineers
Upper Mississippi Basin Com. Nat. Res. Planning Board	Drain Tile Committee American Society for Test. Mtls.
Secretary, Cent. Ill. Section Am. Soc. of Civil Engineers	Hydrology of Mississippi Basin American Geophysical Union

James J. Doland — Professor — Appointed 1936

	(Appointed 1936)
Com. on Surface Water Supply American Water Works Ass'n.	Chairman, Student Chapter Com. Cent. Ill. Sec., A. S. C. E.
Faculty Adv., Student Chapter Am. Soc. of Civil Engineers	Chairman, Student Chapter Com. Am. Soc. of Civil Engineers
Junior Membership Board Am. Soc. of Civil Engineers	Secretary, Illinois Section American Water Works Ass'n.
Consultant National Resources Committee	Yield of Reservoirs American Water Works Ass'n.
Com. on Noble Prize Award Am. Soc. of Civil Engineers	Surface Water Collection American Water Works Ass'n.
Vice-Ch., Proj. Evaluation Nat'l. Res. Planning Board	Secretary, Illinois Section American Water Works Ass'n.
Chairman, Coop. Investigations Com. Nat'l. Resources Planning Board	

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Thomas C. Shedd — Professor — Appointed 1922

1934 to 1942 inc.	1925 to 1933 inc.
Chairman, Program Committee Cent. Ill. Sec., A. S. C. E.	Chairman, Structural Section Illinois Society of Engineers
Iron and Steel Structures American Railway Engr. Ass'n.	Program Committee Cent. Ill. Sec., A.S.C.E.
Secretary, Ill.-Ind. Section Soc. for Promotion of Engr. Ed.	Building Code Committee Cent. Ill. Sec., A.S.C.E.
Chairman, Sub-Com. Steel Rigid Frames American Railway Engr. Ass'n.	Exec. Com., Structural Sec. Am. Soc. of Civil Engrs.
Sub-Com. on Structural Design Civil Engr. Div., S. P. E. E.	Student Awards Committee Cent. Ill. Sec., A.S.C.E.
Sub-Com. on Structural Joints American Soc. of Civil Engr.	
Sectional Committee Z-10 American Standards Association	
Sub-Com. Symbols for Struct. Analysis American Standards Association	
Chairman, Legislative Committee Illinois Engineering Council	
Director Illinois Engineering Council	
Vice-President Illinois Engineering Council	
President Illinois Engineering Council	

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Jamison Vawter — Professor — Appointed 1922

1934 to 1942 inc.	1925 to 1933 inc.
Masonry Committee American Railway Engineering Association	Sub-Com. Corrugated Metal Culverts American Railway Engr. Ass'n.
Sub-Com. on Design (Masonry Com.) American Railway Engr. Ass'n.	Roadway Committee American Railway Engr. Ass'n.
Chairman, Sub-Committee on Foundations American Railway Engr. Ass'n.	Sub-Committee on Roadbed American Railway Engr. Ass'n.
Sub-Committee on Concrete Culverts American Railway Engr. Ass'n.	Sub-Committee, Drainage Areas and Water Runoff American Railway Engr. Ass'n.
Sub-Committee of Masonry Committee on Review of Literature American Railway Engr. Ass'n.	Chairman, Program Committee Central Illinois Section American Society of Civil Engrs.
Sub-Committee on Specifications (Masonry Committee) American Railway Engr. Ass'n.	Masonry Committee American Railway Engineer Association
Board of Directors Illinois Engineering Council	Sub-Committee on Foundations American Railway Engr. Ass'n.

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Carroll C. Wiley — Professor — Appointed 1908

1934 to 1942 inc.	1925 to 1933 inc.
Director, Annual Conference on Highway Engr., Univ. of Illinois	Director, Annual Conference on Highway Engr., Univ. of Illinois
Speed Control Committee National Safety Council	Committee on Portland Cement Governor of Illinois
Educational Committee Institute of Traffic Engrs.	Constitutional Committee Illinois Society of Engineers
Chairman, Short Course Sub-Com. Institute of Traffic Engrs.	Executive Board, Cent. Ill. Sec. Am. Soc. of Civil Engrs.
Champaign Traffic Commission	Board of Directors Illinois Society of Engineers
Highway Committee Governor's Tax Conference	Chairman, Highway Division Illinois Society of Engineers
Highway Survey Committee 61st General Assembly State of Illinois	President, Cent. Ill. Section American Society of Civil Engineers
Resolutions Committee Illinois Society of Engineers	Vice-President, Cent. Ill. Sec. Am. Soc. of Civil Engineers
Uniform Traffic Control Com. Ill. State Safety Commission	Secretary, Cent. Ill. Sec. Am. Soc. of Civil Engineers
Relation of Speed to Highway Accidents National Safety Council	Sub-grade Committee Highway Research Board
Chairman, Roads & Pavements Sec. Illinois Society of Engineers	Local Membership Committee Illinois Society of Engineers
Expansion Joint Committee Governor of Illinois	Legislative Committee Illinois Society of Engineers
	Employment Status Cent. Ill. Sec., A.S.C.E.

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William H. Rayner — Associate Professor — Appointed 1910

1934 to 1942 inc.	1925 to 1933 inc.
Third & Fourth Order Triangulation Com., Am. Soc. of Civil Engrs.	Surveying and Mapping Illinois Society of Engineers
Geodesy & Surveying Comm. Society for Promotion of Engr.Ed.	Specifications for Third Order Triangulation, A.S.C.E.
Surveying Committee Illinois Society of Engineers	Chairman, Award Committee Illinois Society of Engineers
Regional Surveying Conf. Com., Louisville, Ky., S. P. E. E.	
State Surveying Conf. Com. Illinois Society of Engineers	
Regional Surveying Conf. Com. Rolla, Mo., S.P.E.E.	
Topographic Surveys Committee Am. Soc. of Civil Engineers	
Chairman, Topographic Mapping Com. Cent. Ill. Sec., A. S. C. E.	
Vice-Pres., Region 4 Am. Conf. of Surveying & Mapping	

George H. Dell — Assistant Professor — Appointed 1928

Committee on Awards Illinois Society of Engineers	(Appointed 1928)
Auditing Committee Illinois Society of Engineers	Stream Gaging Committee Cent. Ill.Sec., A.S.C.E.
Program Committee Illinois Society of Engineers	
Committee on Mapping Illinois Society of Engineers	
Auditing Committee Cent. Ill. Sec., A. S. C. E.	

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Edward E. Bauer Assistant Professor Appointed 1919

1934 to 1942 inc.	1925 to 1933 inc.
Committee on Junior Awards Cent. Ill. Sec., A. S. C. E.	Roads and Paving Committee Illinois Society of Engineers
Committee on Membership Certificates Illinois Society of Engineers	
Chairman, Foundation and Soil Mechanics Committee Soc. for Promotion of Engr. Ed.	
Engr. Properties of Soils Com. Am. Soc. for Testing Materials	
Sub-Com. on Nomenclature & Definition, Soils Com., A.S.T.M.	
Sub-com. on Soil Classification Soils Com., A. S. T. M.	
Sub-com. on Physical Characteristics Soils Com., A. S. T. M.	
Sub-Com. on Compressability and Elasticity, Soils Committee Am. Soc. for Testing Materials	
Bituminous Waterproofing and Roofing Materials Committee Am. Soc. for Testing Materials	
Chairman, Com. on Foundation and Soil Mechanics Soc. for Promotion of Engr. Ed.	
Com. on Audit and Finance Illinois Society of Engineers	
Exec. Com., Civil Engr. Div. Soc. for Promotion of Engr. Ed.	
Editor of Civil Engr. Div. Soc. for Promotion of Engr. Ed.	
Secretary, Civil Engr. Div. Soc. for Promotion of Engr. Ed.	

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William A. Oliver — Assistant Professor — Appointed 1929

1934 to 1942 inc.	1925 to 1933 inc.
Vice-Chairman, Com. on Wood Bridges and Trestles American Railway Engr. Ass'n.	(Appointed 1929)
Chairman, Sub-Com. Bearing Power Wooden Piles American Railway Engr. Ass'n.	Committee on Wood Bridges and Trestles American Railway Engr. Ass'n.
Committee on Timber Am. Soc. for Testing Materials	
Com. on Design of Timber Structures Am. Soc. of Civil Engineers	
Local Membership Committee Am. Soc. of Civil Engineers	
Chairman, Structural Section Illinois Society of Engineers	
Pres., Champaign County Chapter Illinois Society of Engineers	
Chairman, Publication Committee Illinois Society of Engineers	
Program Com., Cent. Ill. Sec. American Society of Civil Engrs.	
Com. on Structural Engineering Soc. for Promotion of Engr. Educ.	

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Nathan M. Newmark Research Assistant Professor Appointed 1934

1934 to 1942 inc.	1925 to 1933 inc.
Practical Application of Modern Stress Theories & Fatigue Res. Am. Soc. of Civil Engineers	(Appointed 1934)
Com. on Monolithic Concrete Walls American Concrete Institute	
Fundamentals Controlling Struct. Design, Am. Soc. of Civil Engr.	
Stresses in Earth Masses Com. Highway Research Board	
Standard Building Code Com. American Concrete Institute	
Survey of Struct. Research Com. American Concrete Institute	
Sub-Com. on Floors American Concrete Institute	
Sub-Com. on Flat Slabs American Concrete Institute	
Sub-Com. on Footings American Concrete Institute	
Design of Struct. Members Com. American Soc. of Civil Engr.	
Masonry & Reinforced Concrete Com. Am. Soc. of Civil Engineers	
Chairman, Design of Reinforced Concrete Slabs Committee American Concrete Institute	

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Articles and Committees of Those Who Have Resigned from Staff

Between 1925 and 1942

For the Period While They Were Members of the Staff

PAPERS, ARTICLES, AND REPORTS

1934 to 1942	1925 to 1933
By Hardy Cross, Professor	
(Resigned in 1937)	Secondary Stresses in Bridges Proc., Am. Soc. of Civil Engrs.
Structural Analysis & Design Trans., Am. Soc. of Civil Engrs.	Moment Distribution Trans., Am. Soc. of Civil Engrs.
Limitation in Structural Analysis and Design Engineering News-Record	Continuity in Reinforced Concrete Jour., Am. Concrete Institute
Common Sense in Struct. Design Civil Engineering	Continuous Frame Analysis Proc., Am. Concrete Institute
Why Continuous Frames Jour., Am. Concrete Institute	Columns in Flexure Proc., Am. Soc. of Civil Engrs.
Interaction Between Web and Superstructure Proc., Am. Soc. of Civil Engrs.	Rigid Frame Design Journal, American Concrete Institute
Importance of Teaching School Jour., Soc. Proc. Engr. Ed.	Mackensack Bridge Failure Engineering News-Record
	Time Yield in Concrete Jour., Am. Concrete Institute
By T. D. Mylrea, Assistant Professor	
	(Resigned in 1928)
	Design of Multiple Arch Struct. Proc., Am. Soc. of Civil Engrs.
By H. E. Wessman, Instructor	
	(Resigned in 1929)
	Engineering Salaries and Unions Engineering News-Record
	Initial Tension in Rivets Engineering News-Record

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1934 to 1942 1925 to 1933

By C. C. Williams, Head of Department

(Resigned in 1926)

Report of Effect of Speed on
Cost of Transportation
A. R. E. A. 1926

Correlation of Transportation
Facilities
Engineering & Contracting, 1926

Bottle Neck of Highway
Transportation
Engineering & Contracting 1925

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COMMITTEES OF TECHNICAL SOCIETIES

1934 to 1942	1925 to 1933
Hardy Cross, Professor	
(Resigned in 1937)	Committee on Prizes Am. Soc. of Civil Engrs.
Building Code Committee American Concrete Institute	Roadway Committee Am. Railway Engr. Ass'n.
Masonry Committee Am. Railway Engr. Ass'n.	Building Code Committee American Concrete Institute
Iron and Steel Struct. Com. Am. Railway Engr. Ass'n.	Chairman, Structural Division Illinois Society of Engineers
Chairman, Masonry Committee Am. Soc. of Civil Engrs,	Masonry Committee Am. Railway Engr. Ass'n.
Rigid Frame Bridges Com. American Concrete Institute	Rigid Frame Design American Concrete Institute
Committee on Flow American Concrete Institute	Extension Lecture Committee Illinois Society of Engineers
Com. on Graduate Study Soc. for Pro. Engr. Ed.	Iron and Steel Struct. Am. Railway Engr. Ass'n.
Education Committee Western Soc. of Engrs.	
T. D. Mylrea, Assistant Professor	
	(Resigned in 1928)
	Committee E-1 American Concrete Institute
	Reinforced Concrete Committee Engr. Institute of Canada
H. E. Wessman, Instructor	
	(Resigned in 1929)
	Director, Structural Division Illinois Society of Engineers

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1934 to 1942	1925 to 1933

By C. C. Williams, Head of Department

(Resigned in 1926)

Com. on Economy of Railway Operation
Am. Ry. Engr. Ass'n.

Chairman, Sub-Com. of Effect of Speed on Operation Cost
Am. Ry. Engr. Ass'n.

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